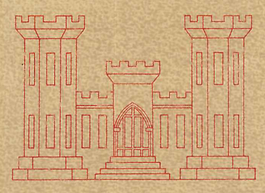
FORT RILEY, KANSAS

TERRAIN ANALYSIS



PREPARED BY

SOIL SYSTEMS, INC.,

MARIETTA, GEORGIA

UNDER THE DIRECTION OF

THE TERRAIN ANALYSIS CENTER

U.S. ARMY ENGINEER TOPOGRAPHIC LABORATORIES

FORT BELVOIR, VIRGINIA 22060

DECEMBER 1977

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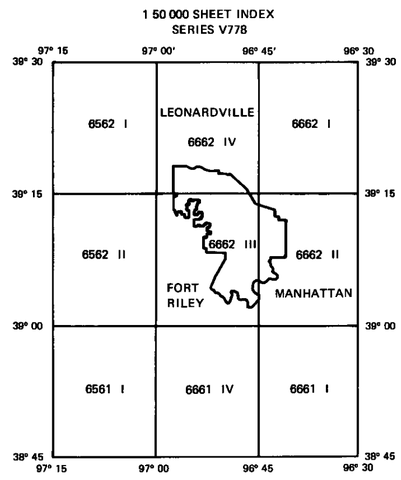

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CONTRACT NUMBER DAAK-70-77-C-0071

DECEMBER 1977

I. INTRODUCTION

BACKGROUND

The requirement for this terrain analysis of Fort Riley was stated in message P241854Z, Oct 75, from the Commander, FORSCOM to the Office Chief of Engineers (OCE), Department of Army, subject "Terrain Analysis of Selected FORSCOM Installations" The FORSCOM requirement identified the installations including Fort Riley, and cited topical coverage to be included in the studies Responsibility for management and supervision of the program developed in response to the FORSCOM requirement was assigned by OCE to the Terrain Analysis Center (TAC), US Army Engineer Topographic Laboratories At FORSCOM request, TAC responsibility also includes technical supervision and direction of FORSCOM troop units assigned to the program

Scope and content of the topical coverage included in the FORSCOM requirement were developed jointly between representatives of TAC and FORSCOM Headquarters Analytical and cartographic specifications for the studies were developed by TAC, coordinated with OCE and concurred in by FORSCOM Headquarters

This study was prepared by Soil Systems, Inc , (SSI) Marietta, Georgia, (Contract number DAAK-70-77-C-0071) under the direction of TAC Earth Satellite Corporation, Chevy Chase, Maryland, provided cartographic services and technical support under sub-contract to SSI

PURPOSE

In stating the requirement for terrain analyses of selected installations, FORSCOM indicated that the purpose of the program is to assist military planners in future stationing decisions To achieve this purpose, planners must obtain an appreciation of the on-post terrain that includes among many other things, knowledge of the suitability for conducting field training exercises involving maneuverability of troops and military vehicles The degree of maneuverability that can be achieved is a function of several terrain factors including slope, surface configuration, soils, vegetative cover, and surface drainage, all of which are treated in the studies

Planners concerned with troop stationing also need certain off-post information such as statistics on housing, schools, hospitals, and public utilities in urban areas near installations, as well as pertinent data on airfields and ports in the vicinity These things are also treated in the studies

Since the program under which this study was prepared is intended to serve troop stationing requirements, the support provided by the program to environmental requirements is only incidental While some of the information contained in the studies may be useful as environmental base line data, the studies are by no means complete environmental inventories of the kind required in support of environmental impact assessments

SCOPE

In scope, the terrain analysis is a compendium of available data on the pertinent natural and manmade features of the reservation and an evaluation of their effects on tactical military operations The program does not include basic research to fill gaps in these data although some short-term field investigations were performed to obtain ground truth and a general overall appreciation of terrain elements Therefore, the scope of the analysis is limited primarily to those factors which have been documented by other authorities and to the results of analysis and evaluation of those factors by project technical specialists for topics such as cross-country movement, cover and concealment, and water resources

The terrain analysis preparation process has necessarily involved analytical judgement in the selection of pertinent source data, resolution of data conflicts, recognition of interrelationships not previously made explicit, and the application of remote sensing to update certain critical, time-variant data such as vegetative cover and manmade features including roads, airfields, and facilities constructed outside of the cantonment areas

LIMITATIONS

The study naturally reflects limitations in the quality, amount, and currency of the source data on which it is based Numerous field interviews and selective use of remote sensing were employed in an effort to assure presentation of the latest and best information Within the relatively complex topical scope of the analysis, however, there are a number of aspects on which source data have not been generated with the focus or recency desired to meet objectives fully. As noted under Scope, the study effort was not designed to include basic research as a means of filling gaps in data

By design, the presentation is cast at a level of data coverage consistent with stated objectives Users interested in deeper pursuit of data are referred to the List of Sources included as the last page of the study

PRESENTATION

Maximum use of graphic presentation has been made throughout the terrain analysis Supporting text is, as far as practicable, in tabular format keyed to the related graphics which follow The primary map scale is 1 50,000 For Urban Areas (Cantonment Areas), larger scale maps are used, and for Off-Post Features the map scale is 1 1,000,000

STUDY AREA

The Fort Riley military reservation is in the Osage Plains section of the Central Lowlands physiographic province adjacent to Junction City, Kansas in the northeastern part of the state It extends about 24 kilometers (15 miles) east-west and 29 kilometers (18 miles) north-south and covers 40,470 hectares (100,001 acres) in parts of Clay, Riley, and Geary counties

In general, Fort Riley is situated on a gently rolling, grassy plateau transversed by streams which, in certain areas, through erosion, have caused relatively dramatic changes in elevation The lowest point on the reservation is 317 meters (1,040 feet) at Camp Funston, while the highest point is approximately 427 meters (1,400 feet) atop Artillery Hill, northeast of the Main Post The flattest areas are located within the Kansas River valley which borders the installation on the south and ultimately receives all surface runoff from Fort Riley The southeastern part of the reservation is a higher, moderately to deeply dissected plain with small, but relatively wide, stream valleys These smaller valleys and their adjacent valley sides contain all of the naturally occurring deciduous trees and shrubs in the region The remaining 75 percent of Fort Riley outside of the valleys is generally a tall grass prairie

Climatic conditions are quite variable, with winters being rather cool and dry and summers hot and wet Temperatures range from highs above 32°C (90°F) in the summer to below -18°C (0°F) in the winter Average annual rainfall is about 78 centimeters (30 inches) with the heaviest precipitation period occurring from May through September

II. DESCRIPTION AND MILITARY ASPECTS OF TERRAIN

A. SURFACE CONFIGURATION

Fort Riley is located within the Osage Plains section of the Central Lowlands physiographic province The area is drained by the Kansas River and its tributaries The reservation contains three distinct topographic features the gently rolling loess upland plain, the nearly level alluvial floors of the primary and secondary streams, and the moderately to deeply dissected residual limestone and shale area between The elevation ranges from 312 m (1,025 ft) to 416 m (1,365 ft) above mean sea level

LANDFORM TYPE	LANDFORM DESCRIPTION AND DISTRIBUTION	ELEVATION
1 Low Plains	There are two topographic types included in this landform The gently sloping loess covered plains with portions of the immediately adjacent moderately steep residual landform and the nearly level alluvial plains of the Republican and Kansas Rivers and the major tributary of Wildcat Creek Local relief is between 7 6 m (25 ft) and 18 m (60 ft) Slopes generally are from 3 to 8 percent with a 1 to 15 percent range	The upland gently rolling plain comprises over 80 percent of this unit and lies between the elevations of 353 m (1,160 ft) and 416 m (1,365 ft) above mean sea level The lowest elevation occurs 1 6 km (1 mi) northeast of the town of Milford and the highest near the towns of Bala and Riley The alluvial river floors lie between the elevations of 312 m (1,025 ft) and 365 m (1,200 ft) above mean sea level The lowest elevation is in the Kansas River channel in the Camp Funston Area and the highest in the Wildcat Creek bottoms near the grid coordinates of 895493
2 High Plains	Steep dissected, residual limestone and shale area between the uplands and the valley floors Local relief from 50 m (164 ft) to 73 m (240 ft) Slopes generally are from 20 to 35 percent with an 18 to 60 percent range Steep escarpments have formed in portions of the valley walls of the Republican River, the Kansas River, and Wildcat Creek	Elevations range from 323 m (1,060 ft) to 408 m (1,340 ft) above mean sea level The lowest elevation of 323 m (1,060 ft) occurs in the Camp Funston area The highest elevation of 408 m (1,340 ft) occurs adjacent to Field Strip 4, east of Engineer Road at grid coordinates 985412

B. SURFACE DRAINAGE

All the surface drainage at Fort Riley flows in a generally southward direction into the Kansas River and its tributaries The Kansas River flows eastward to the Missouri and Mississippi Rivers

There is a river gaging station on the Military Highway bridge over the Kansas River between Marshall Field and Main Post It is a telephone activated recording gage with zero reading being 315 2 m (1,034 0 ft) elevation above mean sea level and flood stage being 6 4 m (21 0 ft) The highest reading recorded was 345 m (1,068 5 ft) above mean sea level

Flooding of upland drainageways and small streams is a common occurrence due to the low permeability of the soils Flooding usually lasts for only a few hours Flooding on the Kansas River usually lasts for several days and may persist for a week or longer Large reservoirs have been completed upstream from the reservation and they have had a moderating effect on depth and duration of flooding and minimum flow on the Kansas River

TABLE B-1
DRAINAGE CHARACTERISTICS

DRAINAGE CATEGORIES	GENERAL	REGIME	APPROXIMATE WIDTHS	APPROXIMATE DEPTHS	VELOCITY AND DISCHARGE	BANKS	BOTTOMS
Watercourses							
Republican, Smoky Hill, and Kansas Rivers	The confluence of the Republican and Smoky Hill Rivers is the head of the Kansas River These rivers drain an area extending entirely across the state of Kansas and beyond They meander eastward through broad, 2 to 4 km (1 2 to 2 5 mi) wide terraced floodplains in stable, graded channels All rivers are perennial	Some high water periods from the last of Feb through the first part of June Lowest river stages range from the last of Oct through Jan Flooding occurs with approximately an eight to ten year frequency with average durations of three to five days Ice is common during the last half of Jan and the first half of Feb	Republican River Bank-full, 100 m (330 ft), Normal, 38 m (125 ft), Low, 15 m (50 ft) Note This river passes through Milford Lake near the western boundary of the reservation Smoky Hill River Bank-full, 95 m (312 ft), Normal, 35 m (115 ft), Low, 12 m (39 ft) Kansas River Bank-full, 167 m (550 ft), Normal, 68 m (225 ft), Low, 30 m (100 ft)	Republican and Smoky Hill Rivers Bank-full, 4 m (13 ft), Normal, 0 75 m (2 5 ft), Low, 0 15 m (0 5 ft) Kansas River Bank-full, 6 m (20 ft), Normal, 1 5 m (5 ft), Low, 0 30 m (1 ft) Note The 1951 flood registered 10 5 m (34 5 ft) on the river gage	The 1951 flood was computed as being 8,450 m^3/sec (298,000 ft^3/sec) at the gage, by the Kansas City Dist U S Army Corps of Engrs Mean annual discharge for the Kansas River has been about 80 m^3/sec (2,750 ft^3/sec) and for the Republican River about 25 m^3/sec (850 ft^3/sec) Discharge now modified by recent upstream reservoirs	Bank material can vary greatly within a hundred meters (328 feet) The spectrum ranges from fine sand (SP-SM) to silty clay loam (ML-CL) Bank heights scaled from river cross section surveys and is shown as bank-full depth Outside banks have a slope of greater than 70 percent, inside banks generally in the 5 to 8 percent range	The bottoms are primarily sand with infrequent gravel bars
Wildcat Creek	This perennial stream flows near the northeast boundary of the reservation, its tributaries drain approximately 70 km^2 (27 mi^2) of the area It drains southeastward in a stable channel into the Kansas River with a nearly 0 8 km (0 5 mi) wide, well terraced floodplain	High water period from Apr to June, however, intense thunderstorms may cause flash flooding (lasting less than 12 hrs) into Aug	Bank-full, 14 m (45 ft), Normal, 9 m (30 ft), Low, 4 5 m (15 ft)	Bank-full, 2 4 m (8 ft), Normal, 0 45 m (1 5 ft), Low, 0 15 m (0 5 ft) Low flow maintained by seeps, springs and the town of Riley outfall sewer Scattered pools appreciably deeper	The maximum discharge for 1976 was 52 m^3/sec (1,800 ft^3/sec)	Banks are predominately silty clay loam (CL-CH) 2 4 m (8 ft) in height, box-like in cross section	Bottom predominately silt loam (ML) or silty clay loam (CL) with occasional gravel bars composed of chert fragments
Little Arkansas, Dry, Madison, Sevenmile, Three-mile, Timber, and Wind Creeks	Intermittent secondary streams which drain over 80 percent of the reservation, moderately stable channels	High water anytime after a severe storm, duration less than 6 hours Extended flow duration usually occurs from April to June	Bank-full, 8 m (27 ft), Normal, 3 m (10 ft), Low, 1 0 m (3 ft)	Bank-full, 2 4 m (8 ft), Normal, 0 3 m (1 ft), Low, dry during part of year Normal flow maintained by seeps and springs Scattered pools appreciably deeper	Estimated mean annual discharge for Timber Creek is about 0 1 m^3/sec (3 7 ft^3/sec), for Sevenmile Creek about 0 1 m^3/sec (3 7 ft^3/sec), and for Madison Creek about 0 08m^3/sec (2 7 ft^3/sec)	Banks are generally silty clay loam (ML-CL) with a height of 2 4 m (8 ft), variable box-like cross sections	Generally silt loam (ML) with few, infrequent gravel bars composed of chert fragments
Standing Bodies of Water							
Lakes and Reservoirs (see table below)							

TABLE B-2
LEVEES

MAP NO	NAME OR AREA	NAME OF RIVER	GRID COORDINATES LOCATION OF ENDS		APPROXIMATE DIMENSIONS LENGTH	GREATEST HEIGHT	TOP WIDTH	CONSTRUCTION MATERIAL	DRAINAGE	ESTIMATED RIVER GAGE READING TO OVERTOP AND FREQUENCY	REMARKS
1	Forsyth	Republican	862267	878268	4115 m (13,500 ft)	6 m (20 ft)	3 m (10 ft)	local borrow	Sluice gates 121 9 cm (48 in) diam , 106 7 cm (42 in) diam , headgate culverts 61 cm (24 in) diam , 45 7 cm (18 in) diam	13 4 m (44 ft) 100 yr	This is an old levee and is well protected by heavy sod
2	Marshall Field	Kansas	932234	947255	4191 m (13,750 ft)	5 5 m (18 ft)	Variable 3 to 18 3 m (10 to 60 ft) (see remarks)	local borrow	Sluice gates 121 9 cm (48 in) diam , 91 4 cm (36 in) diam , Flap gate (2) 91 4 cm (36 in) diam , 45 7 x 203 2 cm (18 x 80 in), storm pump 76 2 cm (30 in) over levee	11 0 m (36 0 ft) 100 yr	Rock riprap at critical areas along river face The variable top width is due to the highways which utilize the two side members
3	Funston	Kansas	953299	972313	6797 m (22,300 ft)	5 5 m (18 ft)	4 5 to 5 5 m (15 to 18 ft)	local borrow	Sluice gate 167 6 cm (66 in) diam , Flap gate 45 7 cm (18 in) diam	10 0 m (33 ft) 50 yr	Rock riprap at critical areas along river face Has been recently renovated and the southeast portion relocated

TABLE B-3
LAKES AND RESERVOIRS

MAP NO	NAME	GRID COORDINATES	APPROXIMATE HECTARES/ACRES	STRUCTURE
1	Roblyer Pond	864509	0 4/1 0	Earth dam with drop-inlet
2	Sinn Pond	787464	1 0/2 5	Earth dam with sod spillway
3	Williams Pond	778433	0 4/1 0	Earth dam with sod spillway
4	Rimrock Lake	907334	0 2/0 5	Earth dam with drop-inlet
5	Beaver Lake	927336	0 8/2 0	Earth dam with sod spillway
6	Breakneck Lake	861287	1 3/3 25	Earth dam with sod spillway
7	Moon Lake	901270	3 0/7 5	Earth dam with drop-inlet
8	Whiteside Lake	942287	2 0/5 0	None, Oxbow Lake
9	Funston Lake	977308	10/25	None, Oxbow Lake
10	Marshall Lake	918247	16/40	None, Oxbow Lake

FORT RILEY, KANSAS
TERRAIN ANALYSIS

SURFACE CONFIGURATION

1. LOW PLAINS — Gently sloping to moderately steep upland plains and the nearly level alluvial plains of the Kansas River and its major tributaries. Local relief is between 7.6 m (25 ft) and 18 m (60 ft), slopes mostly 3 to 8 percent, with a 1 to 15 percent range.

2. HIGH PLAINS — Steep residual area between the uplands and the valley floors. Local relief is from 50 m (164 ft) to 73 m (240 ft). Slopes are generally 20 to 35 percent with an 18 to 60 percent range.

Escarpment, nearly 60 percent slope.

SURFACE DRAINAGE

Watercourse width*

- >25 m
- 15 - 25 m
- 10 - 15 m
- 3 - 10 m
- <3 m

76 (250) — Bank to bank width, m/(ft)**

W10 — Lake or reservoir

Stream gage

Earth dam

3 — Flood protection structure (levee)

2m, <15 — Bank height (meters)/slope (percent)

Numbers refer to entries in tables.

* Bank to bank gap width or water width where surface water becomes channelized and has a width greater than 1.5 m (5 ft).

** Measured at high water.

1:50,000 SHEET INDEX
SERIES V778

6562 I	LEONARDVILLE 6662 IV	6662 I
6562 II	FORT RILEY	6662 III, 6662 II, MANHATTAN
6561 I	6661 IV	6661 I

97° 15′ · 97° 00′ · 96° 45′ · 96° 30′ · 39° 30′ · 39° 15′ · 39° 00′ · 38° 45′

Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

C. WATER RESOURCES

1. SURFACE WATER

All of the streamflow from Fort Riley drains into the Republican or Kansas River and then to the Gulf of Mexico by way of the Missouri and Mississippi Rivers Historically, flooding has been a problem for Fort Riley, however, a relatively new system of flood control structures should keep future flood damage to a minimum Information on surface water resources is summarized in Table C-1 U S Geological Survey streamflow gages located on the Republican River and the Kansas River provide adequate streamflow information on the rivers bordering the installation One of the smaller streams has a peak discharge gage while the remaining small streams have no gaging system, therefore, adequate data for an evaluation of the volume of water available from small streams were not available The drainage area of selected streams was measured and mean annual streamflow calculated utilizing information developed by L W Furness (Kansas Streamflow Characteristics, Technical Report No 1) This method uses drainage basin area in square kilometers and regional mean flow figures to estimate mean annual discharge Actual discharge measurements were made on some streams as a tool for evaluating the accuracy of the streamflow determinations The actual discharge measurements and determinations are presented in Stream Discharge Determinations, Table C-2 The calculated mean annual streamflow values were used to develop the discharge categories applied in this study The point at which each category shown on the map starts and ends depends on variations in flow, and moves upstream or downstream reflecting daily, seasonal, or annual variations in the source area, and therefore changes in volume In general, the high-flow period extends from April to July, the low-flow period extends from September to January

TABLE C-1

SURFACE WATER RESOURCES

MAP UNIT	SOURCES	QUANTITY	QUALITY	DEVELOPMENT OF SOURCES
1	The Republican River and Kansas River are located on the southern boundary of the installation The extreme northwest corner of the installation is the farthest point from these sources at 27 0 km (16 75 miles) The rivers are incised below the upland and flow on a broad floodplain	These streams afford much more than 40,000 liters per minute, lpm (15,000,000 gallons per day, gpd) as a mean annual streamflow The minimum discharge of the Kansas River at Fort Riley for the period of record is 169,896 lpm (64,631,520 gpd) The mean annual discharge of the Republican River at Fort Riley for the period of record is 1,471,302 lpm (559,755,583 gpd) The flow of the Republican River has been completely regulated since 1967 by the Milford Lake dam, 2 7 km (1 7 miles) upstream of the Fort Riley boundary	The water quality of the Kansas and Republican Rivers is generally suitable for all uses Both rivers have a pH of approximately 8 0 and are classed as very hard with total hardness measurements of approximately 300 mg/l The quality varies, depending upon the origin of the water flowing into the rivers High surface runoff from contributing areas will result in increased turbidity and bacteriological pollution Low flows result in mineralization problems	Access to both the Kansas and Republican Rivers is limited by fairly steep banks to the floodplain The banks may be 8 to 10 m (26 to 33 ft) high from the water level to the top of the floodplain Trees, heavy undergrowth, and wet areas hinder off-road access to these rivers Both rivers have numerous upstream structures that control flow Both rivers are classified as braided and large shifts in sediment deposits occur during high water flow, this periodic shift in sediment load creates problems for permanent structures built in the river, such as water plant intake pipes and reservoirs
2	The middle reach of Wildcat Creek, and the lower reaches of Timber Creek, Sevenmile Creek, and Madison Creek are all included in this map unit Streams in this map unit are generally less than 6 2 km (3 8 miles) apart	The average yields from these streams are 4,000 to 40,000 lpm (1,500,000 to 15,000,000 gpd) Drastic flow variations routinely occur during the year During winter (low-flow period) the stream flow is reduced to a minimum, during the late spring and early summer (high-flow period) stream flow is increased greatly Occasional intense rainstorms can cause tremendous short-term increases in streamflow	No data are available on natural streams of similar size in the area Based on regional considerations and data, it is estimated that natural stream waters are very hard and have a pH of approximately 8 0	Access to the streams is limited by trees and heavy undergrowth, and in places by wet areas Large seasonal variations in flow make these streams unreliable sources of water These streams are mostly incised into their floodplains with bank heights ranging from 1 5 to 6 1 m (5 to 20 ft) Velocities normally vary from 0 08 to 0 22 m/sec (0 26 to 0 72 ft/sec) but may be greater during high water periods
3	The lower reaches of Fourmile Creek and Threemile Creek comprise this map unit These streams are located in the southern portion of the installation The northwest corner of the installation is the farthest point away from these streams at 26 9 km (16 75 miles)	The average yields from these streams are 400 to 4,000 lpm (150,000 to 1,500,000 gpd) Fourmile Creek has the same variable flow characteristics as similar streams on the installation, low in winter and high in summer Threemile Creek has a fairly uniform flow distribution due to the discharge of approximately 3,900 lpm (1,485,000 gpd) of treated wastewater into a tributary of this stream	Same as streams discussed above The water quality of Threemile Creek is significantly degraded due to the addition of wastewater from the secondary treatment plant located on the stream Water quality records on Threemile Creek maintained by the installation show that the dissolved oxygen level one-half mile above the wastewater discharge point is approximately 12 mg/l, one-half mile below the discharge point the level is approximately 8 6 mg/l	Same as above
4	The middle reaches of Madison Creek and Threemile Creek, and the lower reaches of Dry Branch, Wind Creek, and Honey Creek are all within this map unit Streams in this map unit are approximately 5 km (3 1 miles) apart Streamflow data are nonexistent Stream volume and distance that this category delineates depend on the presence of springs, volume of spring flow, and volume of base flow Stream locations range from channels incised in the upland to ravines and gullies	In the incised channels and gullies, flow usually persists throughout a wet period Flow is generally in the range of 40 to 400 lpm (15,000 to 150,000 gpd) The channel may be dry during low precipitation periods Quantities of water increase downstream, and after intense storms yields may temporarily exceed 400 lpm (150,000 gpd)	No data are available for delineated stream segments Based on regional considerations, it is estimated that natural stream waters are very hard and have a pH of approximately 8 0 Suspended sediment loads are normally high in seasonal streams downstream from areas of active bank degradation	Access to streams is hindered by trees and thick underbrush These streams are unreliable as sources of water due to the seasonal flow characteristics
5	Upper reaches of streams, shown as intermittent streams on topographic maps, are sources for this map unit These streams have flowing water for only a few days following periods of precipitation Streams in this map unit are generally less than 7 6 km (4 75 miles) apart	In the drainageways comprising this map unit, flow is present only for a few days following precipitation Streamflow is generally 4 to 40 lpm (1,500 to 15,000 gpd), however, the channels are dry most of the time After intense storms yields may exceed 40 lpm (15,000 gpd) temporarily	No data are available for delineated stream segments Based on regional considerations, it is estimated that natural stream waters are moderately hard and have a pH of approximately 8 0 Suspended sediment loads are normally low unless the stream source area has been recently disturbed	Due to the highly variable stream flow, development of these streams would not be feasible
6	Extreme upper reaches of ephemeral streams, shown as intermittent streams on topographic maps or not mapped at all, comprise this map unit Streamflow data are nonexistent, and only representative streams are mapped Streams range from shallow drainageways on upland surfaces to steep gullies in areas of hilly terrain Streams in this map unit are generally less than 1 2 km (0 75 miles) apart	In the shallow drainageways and gullies leading from hilly terrain, flow is present only during rainfall and for a few hours thereafter Flow is generally less than 4 lpm (<1,500 gpd) and the channel is dry most of the time After intense storms yields may temporarily exceed 4 lpm (1,500 gpd)	Same as above	Same as above

TABLE C-2

STREAM DISCHARGE DETERMINATIONS

Based on Mean Annual Flow of 0.0022 $m^3/s/km^2$ (0.2 $ft^3/s/mi^2$)

MAP NO	GRID COORDINATES	STREAM	DRAINAGE AREA ABOVE STATION sq km	DRAINAGE AREA ABOVE STATION sq miles	ACTUAL DISCHARGE MAY 19, 1977 lpm*	ACTUAL DISCHARGE MAY 19, 1977 gpd**	COMPUTED MEAN ANNUAL DISCHARGE lpm	COMPUTED MEAN ANNUAL DISCHARGE gpd
1	765510	Timber Creek	47 1	18 2	5,376	2,045,295	6,217	2,365,328
2	887496	Wildcat Creek	51 8	20 0	3,960	1,506,579	6,838	2,601,365
3	981337	Sevenmile Creek	49 2	19 0	5,400	2,054,425	6,494	2,470,795
4	977433	Wildcat Creek	158 8	61 3	21,000	7,989,432	20,962	7,974,841
5	949298	Threemile Creek***	50 2	19 4	+	+	3,903	1,485,000
6	811446	Madison Creek	35 2	13 6	+	+	4,646	1,767,723
7	852265	Fourmile Creek	19 4	7 5	+	+	2,561	974,256
8	924249	Kansas River	116,213 0	44,870 0	+	+	4,678,944	1,780,100,227
9	845266	Republican River	64,465 0	24,890 0	+	+	1,471,302	559,755,583

*Liters per minute
**Gallons per day
***Threemile Creek is normally a seasonal stream but the addition of approximately 3,900 lpm (1,485,000 gpd) of sewage treatment plant effluent puts this stream in the perennial class
+ Not Measured

TABLE C-3

STANDING BODIES OF WATER

LAKES

MAP NO	NAME	GRID COORDINATES	APPROXIMATE HECTARES (ACRES)	QUALITY
W1	Breakneck Lake	861287	1 31 (3 25)	good, very hard
W2	Moon Lake	901270	3 04 (7 50)	good, very hard
W3	Marshall Lake	918247	16 19 (40 00)	good, very hard
W4	Funston Lake	977308	10 12 (25 00)	good, very hard
W5	Beaver Lake	927336	0 81 (2 00)	good, very hard
W6	Williams Pond	778433	0 40 (1 00)	good, very hard
W7	Sinn Pond	787464	1 01 (2 50)	good, very hard
W8	Roblyer Pond	864509	0 40 (1 00)	good, very hard
W9	Rimrock Lake	907334	0 20 (0 50)	good, very hard
W10	Whiteside Lake	942287	2 02 (5 00)	good, very hard

TABLE C-4

ANALYSIS OF SURFACE WATERS, FORT RILEY*

MAP NO	STREAM	DATE	ACTUAL DISCHARGE lpm	ACTUAL DISCHARGE gpd	TEMPERATURE °C	TEMPERATURE °F	pH	CONDUCTIVITY µMHO/CM	BOD_5	DISSOLVED OXYGEN	SUSPENDED SOLIDS	TOTAL DISSOLVED SOLIDS	NH_3-N	NO_3-N	TOTAL PHOSPHATE
									CONSTITUENTS IN MILLIGRAMS PER LITER (mg/l)**						
9	Republican River	28 Jan 76	288,833	109,873,878	3	37 4	8 3	700	1 8	14 2	10	411	0 09	0 9	0 17
9	Republican River	11 Aug 76	258,251	98,240,173	24	75 2	8 2	600	1 8	7 5	23	339	0 28	0 9	0 24
***	Kansas River***	28 Jan 76	971,839	369,693,284	4	39 2	8 1	1,590	2 0	13 0	17	946	0 25	1 8	0 51
	Kansas River	11 Aug 76	810,432	308,293,176	26	78 8	8 5	1,370	4 5	9 3	66	741	0 09	0 2	0 32

*Analyses by Kansas Department of Health and Environment, values are from a once-a-month sampling schedule
**For purposes of this report, mg/l may be taken to be roughly equivalent to parts per million (ppm)
***Samples are from Kansas River at Manhattan, Kansas, approximately 30 6 km (19 miles) downstream from Fort Riley

C. WATER RESOURCES (Continued)

2. GROUND WATER

Abundant supplies of good quality water are available from shallow wells in the Kansas River and Republican River valleys. Wells located on the rest of the reservation would produce only limited quantities of water. River bed seepage, not precipitation, is the major source of ground water recharge for all wells. A summary of ground water resources is given in Table C-5.

Shallow wells in the valley-fill deposits, although undergoing extensive pumping, do not significantly lower the water table; wells in areas other than the river valleys are subject to large fluctuations in water production and water-table levels on a seasonal and yearly basis. These large fluctuations in water production and water-table levels are due to the dependency of these areas on precipitation for ground water recharge.

Ground water quality is usually good and acceptable for all uses with only minor pretreatment. A summary of ground water quality in Geary and Riley Counties is given in Table C-6. There are no major springs on the reservation. Most springs are small and produce water for only part of the year. This fluctuation in flow makes springs unreliable water supply sources.

TABLE C-5
GROUND WATER RESOURCES

MAP UNIT	QUANTITY AND SOURCE	DEPTH	QUALITY	DEVELOPMENT OF SOURCES
1	Very large quantities available from shallow wells in the sands and gravels of the valley-fill deposits in the Kansas River and Republican River valleys. Wells yielding more than 3,785 lpm (1,440,000 gpd) are common, and almost all wells penetrating the full thickness of valley-fill materials yield more than 1,893 lpm (720,000 gpd). Well depths range from 15 to 27 m (50 to 90 ft). Extensive pumping records from wells in the valley fill of the Kansas River and the extension upstream in the Republican River valley indicate the extent and dependability of water supply. Two wells have been used to supply Camp Forsyth, and seven wells serve the remainder of Ft. Riley. All nine wells are within a distance of 2,133 m (7,000 ft) in the valley, and the combined yield is about 21,450 lpm (8,160,000 gpd). The valley-fill deposits, composed of gravel and sand in the lower part, are as much as 27 m (90 ft) thick. They are underlain by the dense, poorly permeable, and compacted Permian and Pennsylvanian rocks that are exposed on the uplands to the north and west. Recharge for the well supply is chiefly from the river and not from precipitation on the rock upland areas. Large additional ground water supplies are available.	The water table is nearly flat in the valley, sloping gradually from both valley walls toward the river. The water table ranges from 0 to 12.4 m (0 to 40 ft) below land surface and averages about 7.6 m (25 ft). The saturated thickness of the valley-fill deposits is more than 12 m (40 ft) in the deepest parts of the valley. Because of the high permeability and the river as a source of recharge, the drawdown of the water table at individual wells is commonly less than 1.5 m (5 ft). Where wells are closely spaced the drawdown is greater but not to the extent of dewatering the aquifer.	The quality of water from wells reflects, to a great extent, the quality of river water, which represents most of the recharge. The total dissolved solids is about 500 mg/l, and the hardness is about 350 mg/l. Iron and manganese occur locally in objectionable amounts and are variable in time at any well. The iron content ranges from 0.00 to about 30 mg/l and averages about 1 mg/l. The manganese almost everywhere exceeds the recognized acceptable limit of 0.05 mg/l.	The wells, which are less than 27 m (90 ft) deep, range in diameter from 40 to 75 cm (16 to 26 in.). They commonly have a 6 m (20 ft) stainless steel screen opposite the best part of the aquifer. Some wells are gravel packed. All the wells have pumping tests run at the beginning to determine long-term yield. Access to suitable well sites may be hindered by cultural features or dense floodplain vegetation.
2	No good aquifer suitable for a large dependable water supply exists north of the valleys of the Republican and Kansas Rivers. This entire area of Permian and Pennsylvanian shales and limestones is considered as a unit. Wells suitable for small drinking supplies are available almost any place from the fractured rock. Wells which end in shale are capable of yielding only a few gallons of water a minute at best. Wells in the limestone formations, which alternate in sequence with the shale in the gently westward sloping formations, have a chance of developing *moderate* supplies of 379 lpm (144,000 gpd) where large fractures are penetrated. Wells in limestone are not consistent in yield from place to place. The contrasting wet and dry seasons cause corresponding high and low yield stages of well yield during a year. Large springs are rare, but small springs are common, some drying up during parts of the year.	Wells as shallow as 15 m (50 ft) in some places and 60 m (200 ft) in others are likely to penetrate fractures below the water table and thus yield some water. No deep permeable aquifers containing fresh water are known.	A systematic study of the quality of ground water in this rock unit has not been made. This water, percolating through fractures in shale and limestone, is likely to be very hard but satisfactory for drinking and most other uses.	Wells cased through soil and weathered rock which open into the hard fractured rock below would be suitable. A diameter of 15 to 20 cm (6 to 8 in.) is adequate for a well in this unit. A concentration of springs and seeps on escarpment faces of the limestone formation suggest that the development of springs or shallow wells in the coves and small valleys might be successful for small to moderate water supplies.

TABLE C-6
CHEMICAL ANALYSIS OF GROUND WATER
FORT RILEY AREA*

	UNITS	AVERAGE	MINIMUM	MAXIMUM
Temperature	°C (°F)	16.9 62.4	12.0 53.6	24.0 75.2
Silica	mg/l**	25	19	27
Iron	mg/l	1.8	0.16	4.3
Manganese	mg/l	1.3	0.2	2.0
Calcium	mg/l	98	70	120
Magnesium	mg/l	18	16	21
Sodium and potassium	mg/l	52	37	99
Bicarbonate	mg/l	343	277	425
Sulphate	mg/l	58	35	84
Chloride	mg/l	42	19	97
Fluoride	mg/l	0.3	0.2	0.5
Hardness as $CaCo_3$	mg/l	315	240	400
Nitrate	mg/l	7.6	0.6	27
pH	none	7.6	7.5	7.8

*Analyzed by the Kansas State Department of Health, between 1960 and 1968. Samples from wells in Geary and Riley Counties, Kansas.

**For the purposes of this study, mg/l may be taken to be roughly equivalent to parts per million (ppm).

TABLE C-7
CHEMICAL ANALYSIS OF GROUND WATER FROM FORT RILEY WELLS
(Sampled in August 1976)

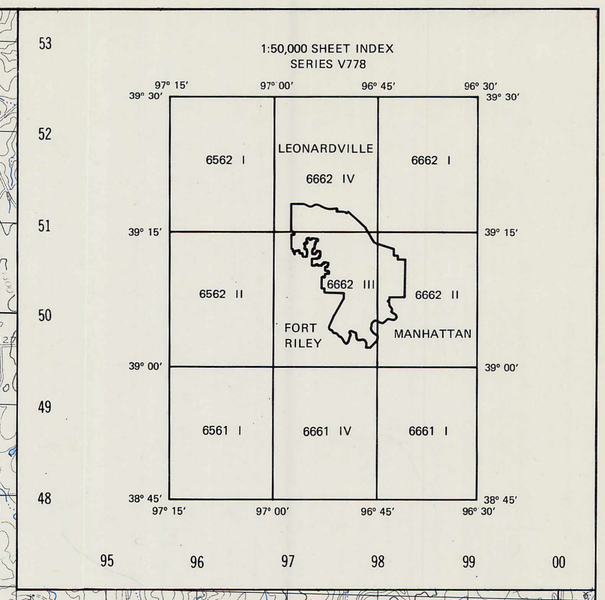
		WELL NUMBER	
	UNITS	5 MAIN POST WELL FIELD	2 FORSYTH WELL FIELD
Silica (SiO_2)	mg/l*	21.8	32.2
Iron (Fe)	mg/l	0.06	0.06
Calcium (Ca)	mg/l	68.3	106.0
Magnesium (Mg)	mg/l	16.0	31.0
Sodium (Na)	mg/l	43.9	15.1
Potassium (K)	mg/l	10.1	4.0
Sulfate (SO_4)	mg/l	97.0	33.3
Chloride (CL)	mg/l	40.8	6.1
Fluoride (F)	mg/l	0.42	0.33
Nitrate (NO_3N)	mg/l	0.7	0.75
Dissolved solids	mg/l	429.0	473.0
Hardness as $CaCO_3$	mg/l	247.0	395.0
Specific conductivity	µmho	680.0	775.0
pH	None	7.85	7.9
color	None	5.0	5.0

All well water is treated with chlorine, sodium hexametaphosphate, and hydrofluosilicic acid before use.

*For the purposes of this study, mg/l may be taken to be roughly equivalent to parts per million (ppm).

TABLE C-8
WELL FIELDS

MAP NO.	NAME	GRID COORDINATES	STATUS
1	Main Post	894265	Contains wells numbered 1 through 7 (Number 2 is inactive).
2	Camp Forsyth	876265	Contains wells numbered 1 and 2.



FORT RILEY, KANSAS TERRAIN ANALYSIS

WATER RESOURCES

SURFACE WATER

FRESH WATER PERENNIALLY PLENTIFUL

1. Enormous* quantities available from the Republican River and Kansas River.
2. Very large quantities available from widely spaced stretches of some streams, less than 7.6 kilometers (4.75 miles) apart.
3. Large quantities available from segments of two streams on the southern portion of the installation.

FRESH WATER SEASONALLY PLENTIFUL

4. Moderate quantities available from widely spaced stretches of some streams, about 6.6 kilometers (4.1 miles) apart.

FRESH WATER SCARCE

5. Small quantities available from minor tributaries about 4.0 kilometers (2.5 miles) apart.
6. Meager quantities available during most of the year from headwaters of streams generally less than 1.2 kilometers (0.75 miles) apart; frequently dry; only representative streams mapped.

1 — Location of single discharge measurement, computation point, or water quality sample point.

W2 — Location of standing water body.

GROUND WATER

FRESH WATER GENERALLY PLENTIFUL

1. Very large* quantities generally available from valley-fill deposits within 15 meters (50 feet) of the land surface.

FRESH WATER LOCALLY PLENTIFUL

2. Moderate quantities available from limestone formations where large fractures are penetrated within 15 to 60 meters (50 to 200 feet) of the land surface.

2 — Well field

Except for point-discharge measurements or calculations, the data portrayed on this map are based on subjective evaluations without support of long-period records.

* Definitions of underlined terms are as follows:

	Liters Per Minute (lpm)	Gallons Per Day (gpd)
Enormous	>40,000	>15,000,000
Very Large	4,000 - 40,000	1,500,000 - 15,000,000
Large	400 - 4,000	150,000 - 1,500,000
Moderate	40 - 400	15,000 - 150,000
Small	4 - 40	1,500 - 15,000
Meager	<4	<1,500

USER NOTE: For permissible concentrations of impurities in military water supplies, see Field Water Supply, TM-5-700, July 1967, paragraph 19, or other applicable manuals or regulations.

Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

D. ENGINEERING SOILS

This table and the accompanying engineering soils map were prepared to give a general indication of the engineering properties and distribution of the major soil groups. Their accuracy is considered to be fairly reliable for general planning purposes. They are presented as a guide, and are not intended to supplant detailed on-site investigations for specific uses.

The map was produced after detailed stereoscopic examination of aerial photographs correlated with available information found in the Soil Survey of Riley County and Part of Geary County, Kansas, June 1975. In addition, on-site visits and a low altitude visual aerial survey were made of inaccessible areas. A number of soil samples were taken and laboratory classification tests were performed for verification purposes. The soils were grouped into eight map units, each containing soils having generally similar engineering properties. These units have been evaluated as to limitations (slight, moderate or severe) for seven engineering applications. The characteristics causing the limitations are listed in a legend at the bottom of the table. Expediency dictates that within any of the map units, there will be, of necessity, inclusion of soils whose profiles differ from the typical profile given. Effort was made to keep these to a reasonable minimum. The profiles shown for each map unit are considered to be typical for the unit but some variation may be expected in the actual thicknesses of the various layers and in the depths to bedrock. Military Planners and Engineers can use this information for preliminary estimates. However, for specific requirements a more detailed analysis supported by on-site study will be necessary.

Fort Riley is located in the Central Great Plains Winter Wheat and Range land resource region.

The elevation varies from 312 m (1,025 ft) to 416 m (1,365 ft) above mean sea level. This general area has been covered with a foot or less of loess (wind-blown material) that rests upon alternating strata of weathered limestones and shales. Most soils are friable silty loam, 15 to 30 cm (6 to 12 in.) thick, overlying nearly impervious clays. The restricted permeability, high shrink-swell characteristics of the clay subsoil, and the depth to bedrock are major influences on the engineering uses of the upland soils.

The availability of sand and gravel is limited to the bottomlands of the Kansas and Republican Rivers; however, crushable limestone and chert are readily available throughout the reservation. The U-shaped cross section of the drainage channels prohibit crossings by vehicles in many places. Slopes >50 percent are encountered in the east and south portions of the reservation.

The shallow depth to bedrock, the presence of chert fragments in the surface soils, and the extreme hardness of the clay subsoil when dry make it difficult to dig foxholes, latrines, or other shallow excavations.

SOIL CHARACTERISTICS AND SELECTED EVALUATIONS

MAP UNIT	AREA (KM²) MAPPED ON RESERVATION	LANDFORM AND SLOPE	TYPICAL SOIL PROFILE[1]—LAYERS, THICKNESS OF LAYERS, DEPTH TO ROCK, UNIFIED ENGINEERING CLASSIFICATION[2] (PROFILES NOT TO SCALE)	HIGH-WATER TABLE (DEPTH AND DURATION)	PERMEABILITY	SHRINK-SWELL POTENTIAL	RATING AND MAJOR KINDS OF LIMITATIONS FOR: SEWAGE LAGOONS	SANITARY LANDFILL	FOUNDATION FOR SMALL BUILDINGS	ROAD LOCATION	SHALLOW EXCAVATION	TRAFFICABILITY	BIVOUAC SITES	REMARKS
1	52.0	Areas of nearly level floodplains. Slopes generally 0 to 3 percent; however, the Breaks-Alluvial Land Complex has a 0 to 50 percent range.	Map unit too variable to show a typical profile. Soils vary from fine sand to silt and silty clay. Depth to bedrock ranges from 1.3 to >3.0 m (4 to to >10 ft).	None	0.5-20.3 cm/hr (0.2-8.0 in./hr)	Variable	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Severe (f)	Major soil series:[3] Alluvial, Breaks-Alluvial, Carr-Sarpy, Haynie, Ivan-Kennebec, and Sarpy. Soils vary broadly in texture from sand to clay. Flooding on upland secondary streams usually lasts only a few hours. Flooding of the Kansas and Republican Rivers usually lasts a few days but may persist for a week or more. Some areas are protected by levees; however, they are mapped as if in their natural state.
2	13.0	Well-drained terraces along primary streams. Slopes generally 2 percent with 0 to 3 percent range.	ML or CL: Grayish-brown silty clay loam. Depth to bedrock is >3.0 m (>10 ft).	None	1.5-5.0 cm/hr (0.6-2.0 in./hr)	Low	Moderate (e)	Moderate (e)	Slight to Moderate (l)	Slight to Moderate (l)	Slight	Slight to Moderate (l)	Slight	Major soil series: Eudora and Muir. The Eudora soils have a layer of very fine sandy loam at a depth of 45 to 90 cm (18 to 36 in.).
3	2.7	Poorly drained terraces along primary streams. Slopes generally vary from 0 to 1 percent.	m .15: CL / CH: Dark gray silty clay. Dark gray to grayish-brown silty clay. Depth to bedrock is >3.0 m (>10 ft).	None	0.15-0.50 cm/hr (0.06-0.20 in./hr)	Moderate to High	Slight to Moderate (w)	Moderate (l,r,v,w)	Moderate (l,r,v,w)	Moderate (l,r,v,w)	Slight to Moderate (w)	Moderate to Severe (l,w)	Moderate to Severe (l,r,w)	Major soil series: Chase and Sutphen. Surface runoff and internal drainage are poor. Moderately to highly expansive clay soils.
4	11.0	Deep, moderately permeable, nearly level to gently sloping soils on broad ridges and along secondary streams. Slopes generally 2 to 6 percent, with a 1 to 8 percent range.	m .20: ML / CL or ML: Dark grayish-brown silt. Brown silty clay loam. Depth to bedrock is >1.2 m (>4 ft).	None	1.5-5.0 cm/hr (0.6-2.0 in./hr)	Low to Moderate	Moderate (e,s)	Moderate (c,s)	Slight to Moderate (l,s)	Slight to Moderate (l)	Slight	Slight (l)	Slight	Major soil series: Geary, Ivan. The uplands are comprised of soils that have formed from loess (wind blown material). Alluvial soils of this unit have been water sorted and hence have similar grain sizes.
5	110.0	Nearly level to gently sloping soils on broad ridges and along terraces of secondary streams. Slow permeability. Slopes generally 2 to 6 percent, with a 1 to 8 percent range.	m .30: CL / CL or CH: Dark gray silty clay loam. Dark grayish-brown silty clay. Depth to bedrock is >1.2 m (>4 ft).	None	0.15-1.50 cm/hr (0.06-0.60 in./hr)	Moderate to High	Slight to Moderate (s)	Severe (l,r,s,v)	Moderate (l,v,s)	Moderate (l,v)	Slight (c)	Moderate (l,c)	Moderate (r)	Major soil series: Reading, Tully, and Wymore. Upland soils are formed from loess and the terrace soils from silty clay alluvium. Some small rock outcrop areas, less than .4 ha (1 acre) in size, are present.
6	103.0	Moderately well-drained. Gently to moderately sloping upland soils. Slopes generally 2 to 6 percent, with a 1 to 8 percent range.	m .20: ML CL / CH: Dark gray silt loam to silty clay loam. Brown silty clay. Depth to bedrock is 1 to 1.5 m (3.3 to 5 ft).	None	<0.15 cm/hr (<0.06 in./hr)	High	Moderate to Severe (b,s)	Severe (b,c,s)	Severe (b,l,r,v)	Moderate to Severe (b,l,r,v)	Moderate to Severe (b,c)	Moderate (c,l)	Severe (c,r)	Major soil series: Dwight and Irwin. These soils have developed primarily from weathered shale and become very hard when dry. Rock outcrops less than .4 ha (1 acre) in size are frequently found in this unit.
7	89.0	Well-drained, sloping to moderately steep upland soils that are shallow to bedrock. Slopes generally 6 to 12 percent, with a 5 to 20 percent range.	m .30: ML or CL / CH to GC: Dark gray silty clay loam to cherty silt loam. Variable-colored silty clay to cherty silty clay loam. Depth to bedrock varies from 0.15 to 1.0 m (0.5 to 3.3 ft).	None	0.15-1.5 cm/hr (0.06-0.60 in./hr)	Moderate to High	Severe (b,s)	Severe (b,s)	Severe (b,l,s,v)	Severe (b,l,s,v)	Severe (c,b,g,s)	Moderate (b,s)	Moderate to Severe (b,g,r,s)	Major soil series: Benfield-Florence complex and the Clime-Sogn complex. These residual soils are formed from shale and cherty limestone. They are highly variable and have a wide texture range. This unit contains very frequent linear bands of bedrock outcrops. Surface in the outcrop areas is covered with up to 85 percent of chert fragments.
8	24.0	Steep, stony valley walls along primary and secondary streams which contain many bedrock outcrops. Slopes generally 30 to 50 percent with a 20 to 60 percent range.	Map unit too complex to show a typical profile. Depth to bedrock highly varied but soil generally very shallow.	None	Variable	Variable	Severe (b, g, s)	Severe (b, g, s)	Severe (b, g, s)	Severe (b, g, s)	Severe (b, g, s)	Severe (b, g, s)	Severe (b, g, s)	Major soil series: Stony Steep Land. The soils are somewhat similar to Map Unit 7, except there are more bedrock outcrops, and the surface has a continuous cover of chert fragments. The steep slope is the major limiting engineering factor.
Total	404.7													

[1] A soil profile is a vertical section of the soil through all its horizons and extending into the parent material. The profiles in this table are typical for the map unit and may vary somewhat in texture and thickness; depth to bedrock may differ significantly.

[2] The Unified Soil Classification System, Technical Memorandum No. 3-357, U.S. Army Corps of Engineers, March 1953.

[3] Soils that have similar profiles make up a soil series. The major series is the common name of the soil, derived from a town or geographic feature near where a soil of that series was first observed. Other minor soil series may be included within the map unit.

DEFINITIONS OF RATING TERMS

SLIGHT—relatively free of limitations, or limitations are easily overcome.
MODERATE—limitations can be overcome with good planning and/or careful design.
SEVERE—limitations are serious and are difficult to overcome.

SOIL RELATED PROPERTIES AFFECTING LIMITATIONS

b—bedrock at 1 m (3.3 ft) or less
c—clayey
e—excessive permeability
f—flooding
g—gravel or gravel size chert fragments
l—low bearing strength
r—restricted permeability
s—slope
v—volume change (shrink-swell)
w—wetness

FORT RILEY, KANSAS
TERRAIN ANALYSIS

ENGINEERING SOILS

1. Predominantly floodplain soils. Potential flooding hazard.
2. Well-drained, nearly level terraces along primary streams; primarily silt loam and >3 m (>10 ft) to bedrock.
3. Poorly drained, nearly level terraces along primary streams; silty clay with impaired internal drainage and >3 m (>10 ft) to bedrock.
4. Well-drained, gently rolling uplands; silty clay loam soils and >1.2 m (>4 ft) to bedrock.
5. Moderate to well-drained, gently rolling uplands and terraces along secondary streams; silty clay loam with moderately slow internal drainage and >1.2 m (>4 ft) to bedrock.
6. Moderate to well-drained, gently rolling uplands; silty clay with very slow internal drainage and 1.0 to 1.5 m (3.3 to 5 ft) to bedrock.
7. Well-drained, rolling uplands; silty clay and 0.15 to 1.0 m (0.5 to 3.3 ft) to bedrock.
8. Stony escarpments along primary and secondary streams.

1:50,000 SHEET INDEX
SERIES V778

6562 I | LEONARDVILLE 6662 IV | 6662 I
6562 II | 6662 III | 6662 II
6561 I | 6661 IV | 6661 I

FORT RILEY | MANHATTAN

Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

E. ENGINEERING GEOLOGY

Fort Riley Military Reservation, Kansas, lies within the physiographic province generally called the Osage Plains section of the Central Lowlands, an area bordered by the Plains Border section of the Great Plains province on the west and by the Ozark Plateaus on the east. The part of this region encompassing the area of Fort Riley is best described as "scarped plains." Here, strata which dip gently to the northwest have been beveled by an erosional plain sloping eastward. Resistant rock layers forming eastward- or southeastward-facing escarpments are part of an older erosional plain that is now being dissected, and maturity has been reached in the present erosional cycle.

The reservation is divided into three major geological-topographical units. Unit 1, the high uplands or prairies, consists of interbedded limestone and shale of Permian age, flat-lying or slightly dipping. The second unit is the alluvium of wide meander floodplains and associated terraces and also the alluvial bottomlands of small streams and creeks which dissect the first unit. The third unit is broken hilly to steep country composed of interbedded limestones and shales. This unit extends from the borders of the uplands downward to the valley floors or to the river terraces.

Although the uplands have been described as dip slopes of limestone strata, they are almost everywhere covered with a part of various shale units which overlie the scarp-forming limestone. Streams cutting into the thick shale units above the Fort Riley formation limestone have carved much of the area into a rolling plateau.

The larger stream valleys are those of the Smoky Hill River, the Kansas River, and the Republican River. The river valleys are wide with well developed, almost level meander floodplains, and are modified by swamps or oxbow lakes. Terraces which are remnants of a former fluvial or possibly lacustrine deposition occur along the side of the valleys above the present floodplain of the larger streams. Smaller stream beds are principally colluvial (from valley walls), except for the alluvium which is deposited during flooding. In places, the smaller streams are actively widening their valleys, and landslides of considerable magnitude have occurred on the valley slopes.

The valley walls in broken, hilly terrain may form steep escarpments except where the valley of the Kansas River is modified and mantled by thick to thin deposits of loess. In this case, the topography becomes more rolling. Some of the exposed Permian strata which form the escarpments are the Fort Riley, the Towanda, the Florence, the Schroyer, and the Threemile limestone formations which are described in Table E-1.

Quarries in limestone (especially in the Fort Riley and the Towanda limestone formations) provide much aggregate, crushed rock, and dimension stone for use on the reservation. Flat to gently rolling terrain for multi-structure emplacement is extensive in both Units 1 and 2.

TABLE E-1

ENGINEERING GEOLOGY

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATIONS	EXCAVATION FACTORS	PITS AND QUARRIES
1. Interbedded limestone and shale; flat-lying or slightly dipping uplands occasionally mantled by loess deposits.	This unit consists of flat to slightly rolling terrain, often bounded by steep escarpments. Streams and creeks dissecting outcropping shale units have carved much of the unit into rolling plateaus. Most of the terrain has favorable relief for construction sites. Relief ranges from 1.5 m (5 ft) to 87 m (285 ft). Elevations range from 324 m (1,080 ft) above sea level north of Ogden to 410 m (1,365 ft) above sea level east of Bala cemetery. Where limestone crops out, small sinkholes may occur locally and the drainage pattern is deranged. Moderately textured dendritic drainage patterns develop where shale crops out. Where thin sequences of limestone and shale occur, the overall permeability of the limestone is reduced, and a dendritic drainage results. Streams are deflected by joints in the limestone, causing alinements that vary from curving to angular. Landslides, which could be common in this sequence of strata, are limited because slopes are seldom sufficiently steep.	A general description is given of the interbedded limestone and shale and also the loess deposits that compose both Unit 1 and Unit 3, and underlie Unit 2. The principal Permian strata exposed in this unit are the Odell shale; the Cresswell, Luta, and Stovall limestones, and the Grant shale members of the Winfield limestone; the Gage and Holmesville shale members of the Barneston limestone; the Blue Springs and Wymore shale members and the Kinney limestone member of the Matfield shale; and the Havensville shale member of the Wreford limestone. The lower section of the Odell shale is mostly yellow and gray shale containing some calcareous beds. The middle and upper sections are varicolored. Fossils are rare or absent. This shale has an average thickness of 9.1 m (30 ft). The lower section (Cresswell) of the Winfield limestone is a light colored, very persistent, resistant limestone less than 0.9 m (3 ft) thick. The many fossil fragments are not resistant to weathering, and project a relief on the weathering surfaces of about 0.5 m to 0.9 m (1.5 ft to 3 ft). The lower massive section forms cliffs. Overlying this limestone are thinner beds of limestone containing calcite concretions, geodes, and shale locally. The upper section (Luta) consists of thin-bedded limestone and shale and has an average total thickness of 3.9 m (13 ft). Stovall limestone is light colored, flinty, fossiliferous, and nonresistant to weathering. Average thickness is 0.3 m (1 ft). Grant shale is fossiliferous, and locally calcareous with an average thickness of 3.0 m (10 ft). The lower section of the Gage shale is varicolored and has a calcareous zone, or locally a massive limestone bed less than 0.3 m (1 ft) thick. The upper section consists of fossiliferous yellowish–gray shale. Average thickness is 13.7 m (45 ft). Holmesville shale is gray, yellow, green, and red, and argillaceous with an average thickness of 9.1 m (30 ft). Oketo shale is bluish-gray and yellow, calcareous, and contains limestone beds locally. Average thickness is less than 1.8 m (6 ft). Blue Springs shale is varicolored in the lower section and yellow gray above. The upper section is more calcareous. Average thickness is 13.7 m (45 ft). Wymore shale is varicolored with an average thickness of 9.1 m (30 ft). Kinney limestone is a calcareous, fossiliferous zone within the Matfield shale and has an thickness of 0.9 m (3 ft). Havensville shale is gray, argillaceous, and contains fossiliferous transitional zones at the top and bottom section. Average thickness is 3.0 m (10 ft). Loveland loess, deposited during the Illinoian and the early Sangamonian stages of Pleistocene time, locally mantles the sedimentary strata both of Unit 1 and Unit 3. The deepest deposits are in the uplands near the city of Riley. Loess is a quartzose, somewhat feldspathic, clastic sediment composed of a sorted mixture of silt, fine sand, and clay particles arranged in an open, cohesive fabric. Loess contains a high percentage of silt-size particles and is poorly graded.	Refer to Table E-2.	Unit 1 consists of two major rock types, limestone and shale; locally thin to thick deposits of loess overlay the rock. Since each rock type has different engineering characteristics, these materials are discussed separately. Numerous engineering construction materials are found in this unit from crushed rock aggregate to quarried building stone. Most of the terrain consists of flat to gently undulating terrain favorable for multistructure emplacement. The low relief permits straight alinements, with some cut-and-fill grading required for roads, railroads, and airfields. Road alinements often follow the contour of the land to minimize cut-and-fill. Construction is not usually hampered by high groundwater conditions. Because of the presence of interbedded weak shales and jointed limestones, only low to moderate bearing pressures can generally be used for foundations carried down to rock. Compressive rock strengths vary at the Fort Riley Hospital site from about 9 kg/cm^2 (123 psi) to 150 kg/cm^2 (2,100 psi). Shales are often compressible. Gage shale has been reported to be not suitable for foundation support. The shales at Custer Hill and the Grant shale are unusually weak. The Custer Hill shale contains considerable gypsum which may weather and collapse. After exposure to the air by excavation, most shales soften and often disintegrate. Therefore, exposure to the air in foundations should be minimized and, where appropriate, protective measures taken to prevent loss of strength. The shale is not suitable for concrete aggregate, railroad ballast, riprap, building or dimension stone, or roofing stone. Both shale and limestone were used as fill during construction of the Milford dam. Portland cement is made from limestone and clay, or shale, all of which are present on the reservation in abundance. Cement was formerly made at Manhattan. Numerous quarry sites are available where deep overburden is not present, which could be used for production of Portland cement. Rock wool has been made from a mixture of Florence limestone, Oketo shale, Fort Riley limestone, and alluvial clay. The shaly and argillaceous limestones with a high clay content are undesirable for aggregate because of their softness and high absorption. The reddish-brown plastic clay overburden soil generally has a moderate bearing capacity. Swelling of this high liquid limit soil has not been a serious problem although it does occur. The plastic clay overburden soil can be used as structural fill. In fill areas, swelling problems have resulted when the fill was not placed 2-5% above optimum moisture content. If placed below optimum, swelling and foundation cracking may result. At the recommended moisture contents, the allowable bearing capacity of the fill is on the order of 9,800 kg/m^2 (1 tsf). Placement at excessive moisture contents will result in a weak fill. The loess is generally well drained and has vertical permeabilities usually much greater than the horizontal permeability. At Fort Riley, high ground water tables are generally not a problem. High water tables have been encountered in the loess at the hospital and just south of Sherman Heights during particularly wet periods. Road cuts in the loess should be made vertical with deep cuts being benched. The loess can be used as structural fill but is highly susceptible to erosion. Some types of loess are unsuitable for foundation support because they undergo large settlements (collapse) upon saturation. The loess deposits on Fort Riley generally have high clay contents and are not susceptible to collapse. Some of the deep loesses classify as low plasticity clays and hence are suitable for use as impervious cores of dams.	The following describes excavation factors for both Unit 1 and Unit 3. In both units, the same or similar rock strata are encountered with depth. Most of the weathered upper sections of this unit can be excavated with ordinary power equipment; ripping may be required. Lower sections usually will require blasting. The Towanda and Fort Riley limestone formations (predominating in Unit 3) require blasting but are not difficult to excavate. The Fort Riley limestone is harder and more massive than the thin-bedded and platy Towanda. The shale deposits vary from soft weathered layers (often with weak bedding planes) that can be excavated with power shovels or rippers, to indurated layers requiring blasting. The residual overburden can be excavated with ordinary power equipment. The soil cover of both Unit 1 and especially Unit 3 can be thin with frequent rock outcroppings. On shale outcrops, such as that of the northwest part of the reservation, the overburden is deeper. Loess deposits can be excavated with ordinary power equipment. Boulders are not generally present.	All the quarries delineated on the Engineering Geology map are in Unit 1 and Unit 3, and are in limestone. No loess deposits exist in this unit.
2. Alluvium; wide meander floodplains and associated terraces, and narrow alluvial bottomlands of small streams and creeks.	The wide floodplains and terraces of this unit are level to nearly level; alluvial and colluvial deposits of the small streams and creeks have a slight gradient. Most of the wide floodplains and terraces have favorable relief for construction sites. The wide floodplains have the typical characteristics of meander floodplains (oxbows, oxbow lakes, channel scars, slip-off slopes and cut-banks, and meander scrolls). Valley widths vary from 46 m (150 ft) or less in the areas of small streams and creeks to 1,950 m (6,400 ft) in the large floodplain areas. Elevations in the small stream valleys vary from 335 m (1,100 ft) to 396 m (1,300 ft) above sea level. Elevations in the larger floodplains vary from 312 m (1,025 ft) to 354 m (1,160 ft) above sea level. Minor surface irregularities exist in the wide floodplains and terraces. The level terrain of the small stream alluvial valleys has probably been disturbed by landslide debris or colluvial material from oversteepened slopes.	The wide floodplain deposits are deep, stratified, and variable in texture. Surface deposits range from sand to sandy silt. Finer textured mineral soils and organic soils compose much of the oxbow and meander deposits. Layers of clay and silt deposits are encountered with depth. The subsurface conditions encountered in a typical test boring in the wide floodplain areas are summarized in test boring Site 9 of Table E-2. Smaller stream or creek deposits are silt to clay loams of medium to shallow depth.	Refer to Table E-2.	A high ground water table and flooding present a serious problem for construction in this unit. The alluvial soils in general can only support one or possibly two-story structures on shallow foundations although some remedial foundation work may be required. Larger structures will probably require deep foundations. Because of the favorable topography, straight alinements are generally available for road and railroad construction; fill may be required to bring the grade above the design flood elevation. The alluvial soils should be capable of supporting railroads and roadway and airfield pavements. Adequate protection must be provided to protect fills from scouring during floods. Small quantities of stream gravel are available for aggregate in the Smoky Hill and Republican River alluvial deposits. Sand is available for concrete, asphalt, highway subgrades, drains, and for blending. The river bottom north and northwest of Junction City is very sandy and contains many low mounds of wind-blown sand. Most of these dunes are covered with vegetation and are stabilized. Permeability may be too great for the disposal of solid and liquid wastes.	Excavation is possible with ordinary power equipment. Bedrock in the wide floodplains is usually at depths of 15 m (50 ft) or more. Bedrock is closer to the surface in the bottomlands of the small streams and creeks. Little excavation will be required for general highway and airport construction in the wide floodplain area.	A borrow pit of undetermined material is delineated on the Engineering Geology Map.

E. ENGINEERING GEOLOGY (Continued)

TABLE E-1 (Continued)
ENGINEERING GEOLOGY

MAP UNIT	TOPOGRAPHY	ROCK DESCRIPTION	PHYSICAL CONSTANTS	ENGINEERING EVALUATIONS	EXCAVATION FACTORS	PITS AND QUARRIES
3 Interbedded limestone and shale, steep slopes to hilly relief occasionally mantled by loess deposits	This unit consists of steep, massive, limestone escarpments to hilly terrain Where shale is important in the outcropping strata, the terrain becomes more rolling, especially where it has been locally modified by loess deposits Most of this unit is unsuitable for construction sites because of overall steep relief Relief ranges from 18 m (60 ft) to 61 m (200 ft) Elevations vary from 335 m (1,100 ft) at Camp Forsyth to 390 m (1,280 ft) north of Sherman Heights	A general description is given of the interbedded limestone and shale that compose Unit 3 Some of the Permian strata exposed in this unit, forming steep bluffs and escarpments, are the Towanda limestone member of the Doyle shale, the Fort Riley limestone member of the Barneston limestone, the Florence flinty limestone member of the Barneston limestone, and the Schroyer and Threemile limestone members of the Wreford limestone Towanda limestone is yellow, unfossiliferous, thin-bedded, and non-resistant to weathering Near Milford, it forms massive bluffs, but this is due to unusual facies Thickness averages 1 5 m to 4 5 m (5 ft to 15 ft) Fort Riley limestone is white, and the lower beds are massive Below the massive limestone which is found in significant outcrops, the beds are composed of thinner, argillaceous layers Above the massive beds are thinner beds of limestone and shale Near the middle of the Fort Riley formation is a gray-yellow persistent zone of extremely platy argillaceous limestone or calcareous shale The top beds are massive, but less than those of the lower beds Its average thickness is 9 1 m (30 ft) Florence limestone contains large quantities of steel-gray flint or chert and is somewhat fossiliferous The flint consists of very irregular nodules arranged in thin layers This is a series of beds of limestone and flint, but shale breaks are common near the top of the section Its average thickness is 1 1 m (3 5 ft) Most of the Schroyer limestone is flinty, but it generally does contain a bed of non-flinty limestone which outcrops more prominently than does the flinty limestone Its average thickness is 6 1 m (20 ft) The lower section of the Threemile limestone contains abundant flint nodules The middle section, lighter in color, contains little or no flint, and is massive and bold in outcrop The upper section is flinty and thin bedded. Its average thickness is 2 7 m (9 ft) Surface loess deposits are common The most recent deposits mantle the north wall of the valleys of the Kansas and Republican Rivers Many deposits occur near the hospital and the Milford reservoir The loess deposits at the hospital have high densities and may be reworked or collapsed material	Refer to Table E-2	Unit 3 has no flat to gently rolling terrain available for multi-structure emplacement The engineering characteristics are described in Unit 1 for the interbedded limestones and shales and for the loess deposits that compose both Units 1 and 3 The Fort Riley formation is a suitable source of aggregate and building stone It is lightweight and soft, yet durable This material has been used for base course material, in asphalt concrete, and for riprap The Fort Riley formation is not suitable for concrete aggregate (due to a low specific gravity and softness), for railroad ballast, or for roofing stone The Fort Riley limestone has been extensively used as a source of building stone at Junction City and Fort Riley Most of the permanent buildings at the military reservation have been constructed from this rock Massive, nonflinty ledges in the Wreford formation, and massive ledges in the Cresswell limestone afford much material suitable for building stone The upper part of the Fort Riley limestone was used as fill, and the lower part for riprap during construction of the Milford dam The Towanda limestone is a suitable source of aggregate for concrete and asphalt concrete and base courses The Towanda in the Junction City area is better than in the rest of the state, and thus was used for concrete aggregate for the Milford dam It is too thinly bedded and platy for riprap, roofing stone, and dimension stone The aggregate material must be washed, as it contains soft, shaly, clayey, and weathered material This unit, due to its rugged relief, is not suitable for the disposal of solid and liquid wastes Landslides are a potential hazard due to interbeds of permeable and impermeable strata combined with oversteepened slopes	See the description for Unit 1	All the quarries delineated on the Engineering Geology map are in Unit 1 and Unit 3 and are in limestone The Fort Riley and the Wreford limestone are valuable for road construction The quarry at Packer's Hill, near Threemile Creek, and numerous quarries near the reservation have been used for this purpose

TABLE E-2
TEST BORING SITES* AND REPRESENTATIVE SOIL AND ROCK PROPERTIES

SITE 1 — GRID COORDINATES 790511

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0 0 m-3 5 m (0 0 ft-11 5 ft)	Fat clay, dark brown, stiff, damp
3 5 m-5 6 m (11 5 ft-18 5 ft)	Shale, light gray, soft, clayey, calcareous
5 6 m-6 6 m (18 5 ft-21 5 ft)	Limestone (Cresswell), gray-tan, moderately hard, shaly
6 6 m-9 0 m (21 5 ft-29 5 ft)	Shale (Grant), green-gray, clayey, soft to very soft, calcareous
9 0 m-9 4 m (29 5 ft-31 ft)	Limestone (Stoval), gray-tan, moderately hard, dense, cherty
9 4 m-11 9 m (31 ft-39 ft)	Shale, green-gray, soft to very soft, clayey, calcareous
11 9 m-12 5 m (39 ft-41 ft)	Limestone, gray-tan, dense to medium hard, thin-bedded, with alternating green-gray shale beds
12 5 m-21 5 m (41 ft-70 5 ft)	Shale (Doyle formation, Gage member), green-gray, brown, and maroon, soft to very soft, calcareous
21 5 m-27 4 m (70 5 ft-90 ft)	Limestone (Doyle formation, Towanda member), bluish, gray, and yellow, moderately hard, brecciated in upper part, slabby, platy in middle and lower
27 4 m-31 7 m (90 ft-104 ft)	Shale (Doyle formation, Holmesville member), very soft, clayey, calcareous, limestone layers
31 7 m-33 2 m (104 ft-109 ft)	Limy shale (Doyle formation, Fort Riley member), soft, thin- to medium-bedded
33 2 m-38 6 m (109 ft-126 5 ft)	Limestone (Barneston formation, Fort Riley member), gray-tan, moderately hard, dense
38 6 m-39 9 m (126 5 ft-131 ft)	Shale (Barneston formation, Fort Riley member), gray, soft to medium hard, calcareous
39 9 m-43 0 m (131 ft-141 ft)	Limestone (Barneston formation, Fort Riley member), tan-gray, moderately hard, dense, pitted
43 0 m-45 7 m (141 ft-150 ft)	Shale (Barneston formation), gray, soft, calcareous
45 7 m-57 m (150 ft-187 ft)	Limestone (Barneston formation, Florence member), gray, medium-hard, dense, cherty
57 m-61 3 m (187 ft-201 ft)	Shales (Matfield formation, Blue Springs member), gray and red, soft, platy, calcareous, occasional limestone beds

Note No engineering test data were available from this test boring

SITE 2 — GRID COORDINATES 891318

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0 0 m-0 4 m (0 0 ft-1 7 ft)	Lean clay (CL-A)
0 4 m-1 5 m (1 7 ft-4 8 ft)	Fat clay (CH)
1 5 m-3 m 4 8 ft-10 ft)	Fat clay (CH)
3 m-4 6 m (10 ft-15 ft)	Gravelly clay (CL)
4 6 m-6 9 m (15 ft-22 8 ft)	Cresswell limestone, hard to moderately hard, very fine to fine, medium bedded to massive, fractured in places—filled with very soft brown clay
6 9 m-10 0 m (22 8 ft-32 7 ft)	Grant shale, gray-green to gray tan, soft to very soft, silty, occasionally clayey and calcareous
10 0 m-11 4 m (32 7 ft-37 4 ft)	Stovall limestone, light gray, moderately hard to hard, thin to medium bedded, with numerous dark gray, angular chert nodules
11 4 m-16 8 m (37 4 ft-55 ft)	Shale with thin limestone beds

SELECTED SAMPLE 1

Depth	7 1 m-7 4 m (23 2 ft-24 2 ft)
Description	Lean clay (CL)
Moisture Content	27%
Void Ratio	0 74
Saturation	100%
Dry Density	1602 kg/m^3 (99 9 lb/cu ft)
Liquid Limit	39
Plasticity Index	18
Specific Gravity	2 78
Unconfined Compressive Strength	23,945 kg/m^2 (2 45 tons/sq ft)
Gradation	
Sieve Size	Percent Finer
Number 4	100
Number 40	96
Number 100	94
Number 200	93
005 mm	37

SELECTED SAMPLE 2

Depth	10 1 m-10 6 m (33 2 ft-34 7 ft), bottom 7 6 cm (3 in)
Description	Lean clay (CL)
Liquid Limit	37
Plasticity Index	16
Specific Gravity	2 74
Gradation	
Sieve Size	Percent Finer
Number 4	100
Number 40	99
Number 100	99
Number 200	98
005 mm	39

SELECTED SAMPLE 3

Depth	10 1 m-10 6 m (33 2 ft-34 7 ft), top 20 3 cm (8 in)
Description	Lean clay (CL)
Liquid Limit	36
Plasticity Index	14
Specific Gravity	2 70
Gradation	
Sieve Size	Percent Finer
Number 4	100
Number 40	84
Number 100	80
Number 200	78
005 mm	28

*Numbered test boring sites are shown on the Engineering Geology map

TABLE E-2 (Continued)
TEST BORING SITES AND REPRESENTATIVE SOIL AND ROCK PROPERTIES

SITE 3 — GRID COORDINATES 887311

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0 0 m-0 5 m (0 0 ft-1 5 ft)	Fat clay (CH-C) black, stiff, slightly damp
0 5 m-1 3 m (1 5 ft-4 2 ft)	Fat clay (CH) light brown, mottled gray, stiff
1 3 m-1 6 m (4 2 ft-5 4 ft)	Fat clay (CH-C) brown, soft
1 6 m-2 4 m (5 4 ft-8 0 ft)	Lean clay (CL) reddish-brown
2 4 m-3 2 m (8 0 ft-10 5 ft)	Fat clay (CH-C) reddish-brown
3 2 m-7 6 m (10 5 ft-25 ft)	Grant shale, soft to medium hard, with occasional limestone zones

SELECTED SAMPLE 1

Depth	2 m-2 2 m (6 6 ft-7 3 ft)
Description	Lean clay (CL)
Moisture Content	27%
Dry Density	1,523 kg/m³ (95 lb/cu ft)
Liquid Limit	49
Plasticity Index	22
Compressive Strength	1,270 kg/m² (0 13 tons/sq ft)
Gradation	
Sieve Size	Percent Finer
Number 40	100
Number 80	100
Number 100	100
Number 200	98
Number 325	80
005 mm	44

SELECTED SAMPLE 2

Depth	3 2 m-3 5 m (10 5 ft-11 6 ft)
Description	Fat clay (CH)
Moisture Content	29%
Dry Density	1,507 kg/m³ (94 lb/cu ft)
Liquid Limit	63
Plasticity Index	23
Compressive Strength	8,014 kg/m² (0 82 tons/sq ft)
Gradation	
Sieve Size	Percent Finer
Number 40	100
Number 80	98
Number 100	98
Number 200	97
Number 325	90
005 mm	54

SITE 4 — GRID COORDINATES 925278

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0 0 m-3 5 m (0 0 ft-11 5 ft)	Soil and possibly badly weathered shale
3 5 m-4 3 m (11 5 ft-14 0 ft)	Shale, mottled chocolate brown and green, weathered, crumbly
4 3 m-6 8 m (14 0 ft-22 3 ft)	Wymore shale, red and gray, weathered, subfirm, with argillaceous limestone layers or nodules
6 8 m-9 3 m (22 3 ft-30 5 ft)	Schroyer limestone, weathered, thick and thin bedded, partly pitted, cherty, shale layers
9 3 m-9 6 m (30 5 ft-31 6 ft)	Limestone, yellowish-green, badly weathered, soft or weak
9 6 m-10 m (31 6 ft-33 ft)	Shale
10 m-10 4 m (33 ft-34 ft)	Core loss
10 4 m-12 4 m (34 ft-40 8 ft)	Schroyer limestone, argillaceous, with some chert
12 4 m-15 5 m (40 8 ft-50 9 ft)	Havensville shale, in top layer brown, weathered, weak, in middle dark green, thin-bedded, firm, with thin limestone layers, very limy in lower section
15 5 m-18 7 m (50 9 ft-61 5 ft)	Threemile limestone, partly weathered, pitted, cherty, thin and medium bedded
18 7 m-23 2 m (61 5 ft-76 2 ft)	Speiser shale, unweathered, firm to subfirm
23 2 m-23 5 m (76 2 ft-77 2 ft)	Funston limestone, gray, thin bedded, few small pits, brecciated or nodular
23 5 m-24 3 m (77 2 ft-79 6 ft)	Core loss
24 3 m-24 4 m (79 6 ft-80 1 ft)	Shale, gray, massive, subfirm
24 4 m-25 1 m (80 1 ft-82 4 ft)	Funston limestone, light gray, medium bedded, pitted, weathered
25 1 m-26 9 m (82 4 ft-88 2 ft)	Blue Rapids shale, gray, massive, weak in upper section, apparently firm below but weathered
26 9 m-27 1 m (88 2 ft-89 ft)	Gypsum, white, firm, massive
27 1 m-29 9 m (89 ft-98 2 ft)	Blue Rapids shale, dark, massive, firm, unweathered, thin shaly limestone layer in middle section
29 9 m-31 8 m (98 2 ft-104 2 ft)	Upper Crouse limestone, thin bedded, pitted
31 8 m-32 5 m (104 2 ft-106 5 ft)	Limestone, highly argillaceous, transitional to shale below, dark gray, strong, unweathered
32 5 m-34 3 m (106 5 ft-112 5 ft)	Shale, dark gray, very firm, unweathered

Note Ground water was not encountered at the time of drilling

SELECTED SAMPLE 1

Depth	0 0 m-1 22 m (0 0 ft-4 0 ft)
Description	Lean clay (CL)
Moisture Content	13%
Liquid Limit	42
Plasticity Index	22
Gradation	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	97
005 mm	36

SELECTED SAMPLE 2

Depth	1 22 m-3 5 m (4 0 ft-11 5 ft)
Description	Lean clay (CL)
Moisture Content	23%
Liquid Limit	35
Plasticity Index	15

SITE 4, SELECTED SAMPLE 2 (Continued)

Gradation	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	90
005 mm	26
Depth	3 5 m-4 1 m (11 5 ft-13 6 ft)
Description	Lean clay (CL)
Gradation	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	99
005 mm	48

SELECTED SAMPLE 3

Depth	6 8 m-7 2 m (22 3 ft-23 6 ft)
Description	Limestone, gray, massive, pitted
Moisture Content	9%
Dry Density	2,164 kg/m³ (135 lb/cu ft)
Compressive Strength	83 kg/cm² (1,180 lb/sq in)

SELECTED SAMPLE 4

Depth	7 5 m-7 6 m (24 6 ft-25 ft)
Description	Shale, light gray, coarse grained, limy
Moisture Content	13%
Dry Density	1,988 kg/m³ (124 lb/cu ft)
Compressive Strength	8 kg/cm² (123 lb/sq in)

SELECTED SAMPLE 5

Depth	11 9 m-12 m (39 ft-39 5 ft)
Description	Limestone, gray to dark gray, massive and pitted
Moisture Content	4%
Dry Density	2,421 kg/m³ (151 lb/cu ft)
Compressive Strength	168 kg/cm² (2,380 lb/sq in)

SELECTED SAMPLE 6

Depth	25 7 m-25 9 m (84 4 ft-84 9 ft)
Description	Shale, gray to dark gray, laminated, firm, massive, limy
Moisture Content	12%
Dry Density	2,036 kg/m³ (127 lb/cu ft)
Compressive Strength	32 kg/cm² (455 lb/sq in)

SELECTED SAMPLE 7

Depth	26 9 m-27 0 m (88 3 ft-88 6 ft)
Description	Gypsum, white, gray, massive, coarse grained
Moisture Content	20%
Dry Density	2,228 kg/m³ (139 lb/cu ft)
Compressive Strength	10 1 kg/cm² (144 lb/sq in)

SELECTED SAMPLE 8

Depth	33 2 m-33 5 m (109 ft-110 ft)
Description	Shale, dark gray, firm, limy, and massive
Moisture Content	3%
Dry Density	2,485 kg/m³ (155 lb/cu ft)
Compressive Strength	148 kg/cm² (2,100 lb/sq in)

SELECTED SAMPLE 9

Depth	35 3 m-38 5 m (115 9 ft-116 5 ft)
Description	Shale, black, dark gray, laminated, massive, and limy
Moisture Content	11%
Dry Density	2,084 kg/m³ (130 lb/cu ft)
Compressive Strength	33 1 kg/cm² (470 lb/sq in)

SITE 5 — GRID COORDINATES 927276

NO DRILL LOG

SELECTED SAMPLE 1

Depth	0 0 m-6 1 m (0 0 ft-20 0 ft)
Description	Lean clay (CL)
Moisture Content	13%
Liquid Limit	36
Plasticity Index	16
Gradation	
Sieve Size	Percent Finer
Number 40	100
Number 200	84
005 mm	29

SELECTED SAMPLE 2

Depth	6 1 m-12 8 m (20 ft-42 0 ft)
Description	Silt (ML)
Moisture Content	13%
Liquid Limit	20
Plasticity Index	3
Gradation	
Sieve Size	Percent Finer
Number 40	100
Number 200	87
005 mm	13

SELECTED SAMPLE 3

Depth	12 8 m-18 3 m (42 ft-60 ft)
Description	Lean clay (CL)
Moisture Content	20%
Liquid Limit	27
Plasticity Index	7
Gradation	
Sieve Size	Percent Finer
Number 40	100
Number 200	87
005 mm	24

SELECTED SAMPLE 4

Depth	18 3 m-18 9 m (60 ft-62 ft)
Description	Gravelly silt (ML)
Moisture Content	17%
Gradation	
Sieve Size	Percent Finer
Number 40	100
Number 200	92
005 mm	6

SELECTED SAMPLE 5

Depth	18 9 m-21 9 m (62 ft-72 ft)
Description	Silt (ML), water table reached at about 21 3 m (70 ft)
Moisture Content	24%
Liquid Limit	20
Plasticity Index	0
Gradation	
Sieve Size	Percent Finer
1 85 cm (75 in)	79
Number 4	68
Number 10	66
Number 40	66
Number 200	61
005 mm	10

SELECTED SAMPLE 6

Depth	21 9 m-22 2 m (72 ft-73 ft)
Description	Shale, moist, laminations of limestone

Note Ground water encountered at 21 9 m (72 ft)

E. ENGINEERING GEOLOGY (Continued)

TABLE E-2 (Continued)
TEST BORING SITES AND REPRESENTATIVE SOIL AND ROCK PROPERTIES

SITE 6 — GRID COORDINATES 961428

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0.0 m-1.5 m (0.0 ft-4.8 ft)	Lean to fat clay, dark brown to black, stiff, moist
1.5 m-2.9 m (4.8 ft-9.5 ft)	Fat clay, dark brown to black, medium stiff, moist
2.9 m-3.5 m (9.5 ft-11.5 ft)	Fat clay, light brown, medium stiff, moist
3.5 m-4.5 m (11.5 ft-15 ft)	Sandy, clayey gravel, brown, calcareous, shaly, subangular to subrounded
4.5 m-8.2 m (15 ft-27 ft)	Top of bedrock—shale (Blue Springs member), blue-gray, soft, calcareous, clayey
8.2 m-9.4 m (27 ft-31 ft)	Limestone (Kinney member), gray, fine textured, moderately hard
9.4 m-16.8 m (31 ft-55 ft)	Shale (Wymore member), gray, soft, calcareous
16.8 m-20.1 m (55 ft-66 ft)	Limestone (Wreford formation, Schroyer member), gray-white, moderately hard, dense, cherty
20.1 m-25.6 m (66 ft-84 ft)	Shale (Havensville member), gray, soft, limestone stringers
25.6 m-29.6 m (84 ft-97 ft)	Limestone (Threemile member), gray, moderately hard, dense, slightly cherty
29.6 m-no data (97 ft-no data)	Shale and limestone (Council Grove group-Speiser formation)

Note: No engineering test data were available from this test boring.

SITE 7 — GRID COORDINATES 932250

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0.3 m-1.1 m (1 ft-3.5 ft)	Silt, brown, friable to crumbly
1.1 m-2.4 m (3.5 ft-8 ft)	No data
2.4 m-4.9 m (8 ft-16 ft)	Silty sand, sandy silt, tan, very fine
4.9 m-6.6 m (16 ft-21.5 ft)	Sand, tan to brown, fine to medium
6.6 m-7.6 m (21.5 ft-25 ft)	Sand, medium, no more data

Note: Ground water was encountered at 5.4 m (14.6 ft).

SELECTED SAMPLE 1

Depth	0.9 m-1.1 m (3.0 ft-3.5 ft)
Description	Sandy silt (ML)
Moisture Content	9%
Dry Density	1,443 kg/m^3 (90 lb/cu ft)
Liquid Limit	20
Plasticity Index	1
Gradation:	
Sieve Size	Percent Finer
Number 80	95
Number 100	92
Number 200	64
Number 325	36

SELECTED SAMPLE 2

Depth	1.3 m-1.4 m (4.2 ft-4.6 ft)
Description	Silty sand (SM)
Moisture Content	3%
Dry Density	1,603 kg/m^3 (100 lb/cu ft)
Liquid Limit	17
Gradation:	
Sieve Size	Percent Finer
Number 80	98
Number 100	70
Number 200	32
Number 325	14

SELECTED SAMPLE 3

Depth	2.0-2.4 m (6.5 ft-8.0 ft)
Description	Sandy silt (ML)
Moisture Content	6%
Dry Density	1,507 kg/m^3 (94 lb/cu ft)
Liquid Limit	24
Plasticity Index	0

SITE 8 — GRID COORDINATES 954296

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0.0 m-0.6 m (0.0 ft-2.0 ft)	Lean clay (CL)
0.6 m-1.2 m (2 ft-4 ft)	No data
1.2 m-1.8 m (4.0 ft-6.0 ft)	Silt (ML)
1.8 m-2.4 m (6 ft-8 ft)	No data
2.4 m-2.9 m (8.0 ft-9.5 ft)	Lean clay (CL)
2.9 m-3.2 m (9.5 ft-10.5 ft)	Silt (ML)
3.2 m-3.7 m (10.5 ft-12 ft)	No data
3.7 m-4.3 m (12 ft-14 ft)	Fat clay (CH)
4.3 m-4.9 m (14 ft-16 ft)	Fat clay (CH)
4.9 m-5.5 m (16 ft-18 ft)	Lean clay (CL)
5.5 m-6.4 m (18 ft-21 ft)	Lean clay (CL)
6.4 m-7.3 m (21 ft-24 ft)	Sand (SP)
7.3 m-7.9 m (24 ft-26 ft)	Sandy silt (ML)
7.9 m-8.5 m (26 ft-28 ft)	Silty sand (SM)

Note: Ground water was not encountered at the time of drilling.

SELECTED SAMPLE 1

Depth	0.0 m-0.6 m (0.0 ft-2.0 ft)
Description	Lean clay (CL)
Moisture Content	16%
Liquid Limit	29
Plasticity Index	8

SITE 8, SELECTED SAMPLE 1 (Continued)

Gradation:	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	98
.005 mm	20

SELECTED SAMPLE 2

Depth	1.2 m-1.8 m (4.0 ft-6.0 ft)
Description	Silt (ML)
Moisture Content	22%
Gradation:	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	99
.005 mm	18

SELECTED SAMPLE 3

Depth	2.4 m-2.9 m (8.0 ft-9.5 ft)
Description	Lean clay (CL)
Moisture Content	23%
Liquid Limit	31
Plasticity Index	10
Gradation:	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	99
.005 mm	24

SELECTED SAMPLE 4

Depth	2.9 m-3.2 m (9.5 ft-10.5 ft)
Description	Silt (ML)
Gradation:	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number40	100
Number 200	98
.005 mm	14

SELECTED SAMPLE 5

Depth	3.2 m-3.7 m (10.5 ft-12.0 ft)
Description	Fat organic clay (OH)
Liquid Limit	54
Plasticity Index	24
Gradation:	
Sieve Size	Percent Finer
Number 4	100
Number 10	100
Number 40	100
Number 200	100
.005 mm	49

SITE 9 — GRID COORDINATES 924250

DRILL LOG

DEPTH FROM SURFACE	DESCRIPTION
0 m-1.0 m (0 ft-3.4 ft)	Sand (SP)
1.0 m-1.7 m (3.4 ft-5.5 ft)	Silty sand (SM)
1.7 m-2.4 m (5.5 ft-7.5 ft)	Sandy silt (SM)
2.4 m-3.0 m (7.5 ft-10 ft)	Silt (ML)
3.0 m-4.3 m (10 ft-14 ft)	Sand (SP)
4.3 m-4.5 m (14 ft-14.7 ft)	Lean clay (CL)
4.5 m-4.9 m (14.7 ft-16 ft)	Lean clay (CL)
4.9 m-5.0 m (16 ft-16.5 ft)	Silt (ML)
5.0 m-6.4 m (16.5 ft-21 ft)	Lean organic clay (OL)
6.4 m-8.8 m (21 ft-29 ft)	Sand (SP)
8.8 m-12.2 m (29 ft-40 ft)	Gravelly sand (SW), wet
12.2 m-12.5 m (40 ft-41 ft)	Clayey sand (SC), wet
12.5 m-14.0 m (41 ft-46 ft)	Silty gravelly sand (SM)
14.0 m-15.2 m (46 ft-50 ft)	Sand (SW), wet
15.2 m-16.2 m (50 ft-53.2 ft)	Sand (SW) and gravelly sand, wet
16.2 m-17.1 m (53.2 ft-56 ft)	Limestone, light gray to tan, moderately hard to hard, dense, thin bedded (Middleburg limestone)
17.1 m-18 m (56 ft-59.2 ft)	Shale, tan to dark gray, soft, fossiliferous, very calcareous (Hooser shale)
18 m-18.8 m (59.2 ft-61.6 ft)	Limestone, moderately hard to hard, dense, argillaceous, frequent solution pits
18.8 m-20.6 m (61.6 ft-67.5 ft)	Shale, alternating light and dark gray in upper part, dark gray to black in lower part, moderately hard, inter-laminated with calcareous sandstone (Stearns shale)
20.6 m-21.2 m (67.5 ft-69.4 ft)	Limestone, moderately hard, dense, thin bedded, argillaceous, shaly at base
21.2 m-21.3 m (69.4 ft-70 ft)	Shale, soft to moderately hard, laminated

SELECTED SAMPLE 1

Depth	18 m-18.3 m (59.2 ft-60.2 ft)
Description	Limestone, dark gray, shaly, fossiliferous, hard
Moisture Content	5%
Dry Density	2,453 kg/m^3 (153 lb/cu ft)
Modulus of Elasticity	18,790 kg/cm^2 (267,000 lb/sq in.)
Compressive Strength	1,817,890 kg/m^2 (186 tons/sq ft)

SELECTED SAMPLE 2

Depth	21.3 m-21.5 m (70.1 ft-70.8 ft)
Description	Shale, dark gray, moderately hard, laminated
Moisture Content	7%
Dry Density	2,212 kg/m^3 (138 lb/cu ft)
Modulus of Elasticity	11,151 kg/cm^2 (167,000 lb/sq in.)
Compressive Strength	1,075,095 kg/m^2 (110 tons/sq ft)

SELECTED SAMPLE 3

Depth	22.7 m-23 m (74.5 ft-75.5 ft)
Description	Gypsum, white with black specks, hard, massive
Moisture Content	3%
Dry Density	2,356 kg/m^3 (147 lb/cu ft)
Modulus of Elasticity	12,100 kg/cm^2 (172,000 lb/sq in.)
Compressive Strength	1,114,190 kg/m^2 (114 tons/sq ft)

F. SPECIAL PHYSICAL PHENOMENA

Since 1867, 24 earthquakes have been reported that had epicenters within the state of Kansas. Two earthquakes with epicenters in the Manhattan Kansas area had Modified Mercalli intensities of VII. Fort Riley is thus classified in the Damaging Effects category on the Modified Mercalli scale. These two earthquakes occurred near the Nemaha Anticline and the Mid-Continent Geophysical Anomaly (MGA). The Nemaha forms a structural high on the Precambrian surface. The steep east flank is cut with a series of faults, but these faults seldom extend to the ground surface. The MGA is one of the most significant gravity highs in North America, and extends from the Lake Superior region into Central Kansas. The MGA is composed of basic igneous rocks. The Nemaha with its associated faulting, may have caused the damaging earthquakes in Kansas; recent opinions, however, cite the MGA and nearby Kimberlite plugs as the sources.

The Kansas City District of the Corps of Engineers is presently working in cooperation with the Kansas Geological Survey to determine the source or sources of Kansas seismic activity. The last major earthquake was in 1952, along the Nemaha near Oklahoma City, with an intensity of VII to VIII on the Modified Mercalli scale.

S.T. Algermissen, in his "Seismic Risk Studies in the U.S.," 1969, includes the Fort Riley area in Zone 2 (moderate damage). This corresponds to a Modified Mercalli intensity of VII. The horizontal acceleration is considered to be 0.10. Most structures on the reservation are designed for a Modified Mercalli intensity of VI, although some feel that this figure may be too conservative.

Because the river valleys within Fort Riley are primarily sand, the potential for liquefaction during an earthquake exists within this area. Landslides associated with earthquakes were a spectacular feature, especially in loess deposits, during the New Madrid earthquake of 1811. Loess deposits mantling sedimentary strata are present within the reservation.

Numerous sinkholes on upland areas in the reservation area have been described. These sinkholes range in diameter from 9 m to 15 m (30 ft to 50 ft) and in depth from 2.4 m to 3 m (8 ft to 10 ft). One of the larger sinks in the area contains five smaller ones on its floor. The sinks on the reservation have been formed by solution and subsidence of the Fort Riley limestone which lies near the surface in much of the region. The Fort Riley limestone is readily soluble and exhibits well defined jointing. Geary county contains locally disappearing streams, common in limestone terrain.

Landslides are a potential hazard in Unit 3 in the interbedded limestone-shale strata when slopes are over-steepened.

The river bottom north and northwest of Junction City is very sandy and contains many low mounds of wind-blown sand. Most of these dunes are covered with vegetation and are stabilized.

FORT RILEY, KANSAS
TERRAIN ANALYSIS

ENGINEERING GEOLOGY

NUMEROUS ENGINEERING USES

1. Interbedded limestone and shale; flat-lying or slightly dipping uplands occasionally mantled by loess deposits.

SOME ENGINEERING USES

2. Alluvium; wide meander floodplains and associated terraces, and narrow alluvial bottomlands of small streams and creeks.

3. Interbedded limestone and shale; steep slopes to hilly relief occasionally mantled by loess deposits.

Complete map-unit descriptions are given in Table E-1

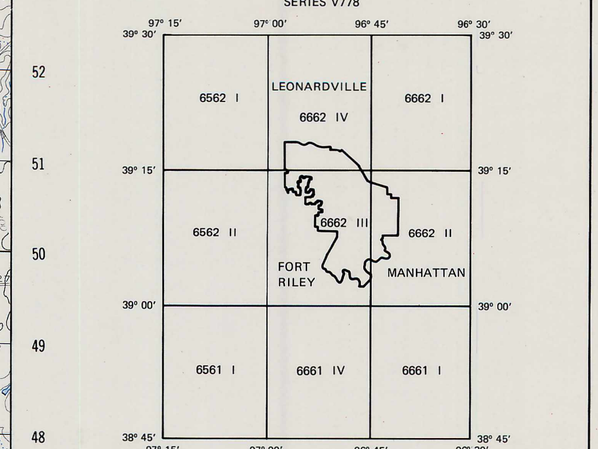
CONSTRUCTION MATERIALS

Borrow pit, generally gravel

Limestone quarry

Test boring site. Descriptions of the unconsolidated and rock materials encountered are summarized in Table E-2.

1:50,000 SHEET INDEX
SERIES V778



Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

G. VEGETATION

The vegetation of Fort Riley generally consists of tall grass prairie with a vegetative cover of about 75% grassland Naturally occurring deciduous trees and shrubs are largely confined to drainageways, floodplains, and their adjacent hillsides The growing season, when deciduous trees are in leaf, begins in late April and ends with the first killing frost in mid-October One coniferous species (eastern redcedar) does occur on the installation but is not significant from a military standpoint

Vegetation interpretations were made from 1 20,000 scale aerial photography dated 27 September 1969, a composite map of 1 50,000 scale U S Geological Survey sheets entitled "Fort Riley and Vicinity, Series V778S", field measurements, a literature search, and several personal interviews All diameter measurements were taken at breast height, 1 37 meters (4 5 feet) above ground level, and stem heights were recorded at total height

MAP UNIT	DESCRIPTION	DISTRIBUTION	REMARKS	COVER	CONCEALMENT
1	Deciduous trees, 50 to 100% crown cover density, averaging 75%, drainageways dominated by bur, red, and chinquapin oaks, American elm, and red mulberry (high on the slopes) and black walnut, black willow, honey locust, and green ash (low on the slopes and along streams), cottonwood, sycamore, box elder, green ash, and hackberry are major floodplain species stem heights range from 4 5 to 13 7 m (15 to 45 ft) along drainageways and up to 30 m (100 ft) on the floodplains, diameters range from 10 to 43 cm (4 to 17 in) along drainageways and up to 130 cm (51 in) on the floodplains, spacing in the drainageways and floodplains ranges from 4 to 10 m (13 to 33 ft) with an average of 7 6 m (25 ft), similar undergrowth in both drainageways and floodplains of very dense gooseberry, redbud, roughleaf dogwood, bristly greenbrier, moonseed, black raspberry, poison ivy, Virginia creeper, and vigorous overstory regeneration	These areas are located mostly east of Old Highway 77 along the tributary streams to the Kansas River and west of Old Highway 77 along Timber Creek and Madison Creek, which drain into Milford Lake	Some black walnut has been planted on the installation within the past 12 years Dutch Elm disease is killing most dominant elms Many mature and overmature stands occur on bottomland sites At present the only forest management practices employed at Fort Riley are those concerned with black walnut husbandry	Cover for foot troops from flat-trajectory fire of small arms is fair to good	Concealment for foot troops from both aerial and ground observation is excellent during the growing season Concealment for vehicles from aerial and ground observation is fair to good during the growing season Concealment from aerial and ground observation during the leafless season is fair to good for foot troops but is poor for vehicles
2	Deciduous trees, 10 to 50% crown cover density, averaging about 25%, predominant species include bur oak, black walnut, American elm, white mulberry, osage orange, hackberry, and honey locust, heights range from 4 5 to 21 m (15 to 70 ft), diameters range from 10 to 76 cm (4 to 30 in), spacing between trees is greater than 9 m (29 ft), dense undergrowth consisting of mostly scrub species such as wild plum, honey locust, lead plant, aromatic sumac, blackberries, poison ivy, Virginia creeper, Russian olive and very good overstory regeneration	Areas of this unit are generally situated in drainageways east of Old Highway 77	Areas of this unit are characterized by either many dead elms, some of which are still standing, causing a considerable decrease in the crown cover density or areas of rocky shallow soils, where tree growth is somewhat restricted	Cover for foot troops from flat-trajectory fire of small arms is poor	Concealment for foot troops is fair from aerial observation and good from ground observation during the growing season During the leafless season concealment for foot troops is poor from aerial observation and fair from ground observation Concealment for vehicles from aerial observation is poor during the growing season and almost nonexistent during the leafless season Concealment for vehicles from ground observation is poor to fair during the growing season and poor during the leafless season
3	Deciduous scrub, 50 to 100% crown cover density, averaging about 90%, consisting of small trees, shrubs, and woody vines such as white mulberry, honey locust, wild plum, redbud, lead plant, smooth and aromatic sumac, roughleaf dogwood, elderberry, prairie rose, grapevine, and Virginia creeper, heights range up to 4 5 m (15 ft), averaging about 3 7 m (12 ft), stout stems averaging 5 to 15 cm (2 to 6 in) in diameter, very closely spaced, undergrowth consisting of annual and perennial weeds	Numerous small areas of this unit are located east of Old Highway 77	This unit describes the characteristic vegetation at the interface between trees and grasses near the upper inflection of the slopes	Cover for foot troops from flat-trajectory fire of small arms is fair to poor	Concealment for foot troops from aerial or ground observation during the growing season is good to excellent Concealment for foot troops during the leafless season is poor from aerial observation and fair from ground observation During the growing season concealment for vehicles is poor from aerial observation and fair from ground observation Concealment for vehicles from ground observation during the leafless season is poor Concealment for vehicles from aerial observation during this season is almost nonexistent
4	Deciduous scrub, 10 to 50% crown cover density, averaging 40%, consisting mostly of small trees and shrubs including white mulberry, honey locust, wild plum, smooth and aromatic sumac, roughleaf dogwood, elderberry, and hawthorn, heights average less than 4 5 m (15 ft), stout stems, 5 to 15 cm (2 to 6 in) in diameter, widely spaced with spreading crowns, annual and perennial weeds and grasses comprise the undergrowth	Many small areas of this unit are scattered over the installation		Cover for foot troops from flat-trajectory fire of small arms is poor to nonexistent	Concealment for foot troops from aerial observation during the growing season is poor, however foot troops are afforded fair concealment from ground observation during this season During the leafless season concealment for foot troops is poor from ground observation and almost nonexistent from aerial observation Concealment for vehicles from aerial observation is almost nonexistent year-round Concealment for vehicles from ground observation is poor during the growing season and poor to almost nonexistent during the leafless season
5	Tall grasses, big bluestem, switchgrass, Indian grass, and little bluestem predominate, heights range from slightly less than 1 m (3 3 ft) to greater than 2 m (6 5 ft)	This is the most extensive unit on the installation Grasses predominate along the upper slopes and ridgetops east of Old Highway 77 and cover most of the area, including shallow drainageways, west of the highway	The entire installation is encircled by a 46 m (150 ft) wide strip of wheat and other grain crops Large portions of the installation are mowed for hay 2 to 3 times per year Many areas north of Highway 82 are being restored to native grasses from weeds and shrubs The grass portions of the installation are being maintained as such by a three year burning rotation	Cover for foot troops from flat-trajectory fire of small arms is nonexistent	During the period from late June through October concealment for foot troops from ground observation is fair to good During the remaining months it is poor to nonexistent Concealment for foot troops from aerial observation is nonexistent Concealment for vehicles is nonexistent from aerial or ground observation year-round

FORT RILEY, KANSAS
TERRAIN ANALYSIS

VEGETATION

FORESTS

1. Deciduous trees; medium to dense spacing
2. Deciduous trees; nearly open to medium spacing

SCRUB

3. Deciduous scrub; medium to dense spacing
4. Deciduous scrub; nearly open to medium spacing

GRASSLANDS

5. Tall grasses

OPEN

6. Built-up areas; barren areas, and heavily used areas. Vegetation not a significant factor.

1:50,000 SHEET INDEX
SERIES V778

LEONARDVILLE 6662 IV
6562 I
6662 I
6662 III
6562 II
6662 II
FORT RILEY
MANHATTAN
6561 I
6661 IV
6661 I

Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

H. CLIMATE

Fort Riley is located in the northeastern section of Kansas between the Tuttle Creek and Milford reservoirs Marshall Army Airfield, the site of the meteorological station, is in a river valley at Latitude 39°03'N, Longitude 96°45'W and an elevation of 324 m (1062 ft), somewhat lower than most of the military reservation The climate of this region is temperate with large year-to-year variability

The annual average temperature at Fort Riley is 12 2°C (54°F) This temperature is the result of hot and often wet summers and cool, dry winters July, the hottest month of the year, has an average daily maximum temperature of 32 2°C (90°F) The highest July temperature over a 14-year period was 42 2°C (108°F) Nearby Manhattan, Kansas, has reached 45 0°C (113°F) more than once In both July and August, more than 50 percent of the days have a maximum reading of 32 2°C (90°F) or more, but only one day in July and four days in August have a maximum of less than 26 7°C (80°F) Occurrences of very hot months are possible as indicated by an average maximum temperature of 37 5°C (99 5°F) in July, 1954 The range of average daily maximum temperatures in July is about 7C° (13F°) The average relative humidity at 1300 local standard time in July is about 50%

The coldest month of the year is January with a mean temperature of -3 1°C (26°F) The normal high temperature during January is above freezing with a value of 2 8°C (37°F) The average minimum temperature is -8 9°C (16°F) During January, only about two days have temperatures which remain above freezing, and about ten days have maximums less than freezing The minimum temperature drops below -17 8°C (0°F) about six days during the winter with four of these occurring in January Temperatures seldom stay below -17 8°C (0°F) for 24 or more consecutive hours The record low temperature for the 14-year period is -32 2°C (-26°F) The cold winter temperatures are often accompanied by strong north or northwesterly winds which can cause conditions to be quite uncomfortable With an average wind speed of about 13 kmph (8 mph) and an average temperature of -3 1°C (26°F), the characteristic wind chill temperature equivalent during January is -12°C (10°F) However, the wind chill equivalent has gone to -46°C (-50°F) and lower and this can be a substantial hazard to personnel engaged in any outdoor activity

Precipitation averages about 785 mm (30 9 in) annually The yearly distribution is such that about 70% of the total falls during the months of April through September The cold season months of November through February average about 23-28 mm (0 9-1 1 in) each The monthly precipitation increases throughout the spring until the yearly maximum of about 132 mm (5 2 in) is reached in June The monthly precipitation total decreases from July through December but it remains above the annual monthly average until November The wet season rainfall is highly variable Every month from June through October has recorded a maximum total precipitation of greater than 250 mm (9 84 in) while each of those months has also had a minimum total of less than 17 mm (0 67 in) As little as 0 25 mm (0 01 in) has been recorded in October and on one occasion all of August passed with no measurable rainfall

The Fort Riley area is occasionally subject to extreme rainfalls of short duration Topeka, Kansas, slightly less than 100 km (62 mi) to the east, has recorded up to 22 mm (0 87 in) in a five minute period and 120 mm (4 72 in) in two hours Twenty-four-hour rainfall totals of more than 125 mm (4 92 in) have occurred about once every nine years. Twenty-four-hour totals of more than 90 mm (3 54 in)have occurred in every month from April through October at Fort Riley Thunderstorms are normally the cause of these heavy rainfall rates

Thunderstorms are common occurrences in the months April through October June is the month with the greatest number, averaging slightly more than ten days with thunderstorms, and July is only slightly behind with about nine thunderstorm days. However, December and January are the only months that normally have no thunderstorm occurrences

Along with the frequent thunderstorms in spring and early summer comes the ever-present threat of hail, strong winds, or tornadoes Tornadoes have occurred in many of the surrounding areas over the years For instance, 12 have been observed and recorded within the boundaries of Topeka The most severe storm caused $100 million damage Damaging hail has also fallen in the vicinity of Fort Riley

Average total annual snowfall at Fort Riley is about 500 mm (20 in). December, January, and March each average about 114-135 mm (4 5-5 3 in) Each of these months has had 24-hour snowfalls in excess of 225 mm (8 86 in) For the four-month period of December through March, roughly 35% of the precipitation is of a frozen form The greatest snow depth recorded at Manhattan, about 560 mm (22 in), occurred during March 1960

The prevailing wind at Fort Riley varies from south to southwesterly except during February and March when the direction veers to northerly The mean wind speed is fairly constant with a minimum value of about 13 kmph (8 mph) in several months to a maximum of 19 kmph (12 mph) in February and March On rare occasions during the summer, strong hot winds may blow from the southwest doing much damage to vegetation in a short period of time.

TABLE H-1 TEMPERATURE, PRECIPITATION, HUMIDITY, WIND, AND VISIBILITY, FORT RILEY[1]

PARAMETER DESCRIPTION		UNIT OF MEASURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	YEARS OF RECORD
Absolute Maximum Temperature		°C	20 6	21 7	30 6	33 3	34 4	39 4	42 2	41 1	44 4	37 8	25 6	22 2	44 4	14
Absolute Maximum Temperature		°F	69 0	71 0	87 0	92 0	94 0	103 0	108 0	106 0	112 0	100 0	78 0	72 0	112 0	14
Mean Daily Maximum Temperature		°C	2 8	5 6	10 0	18 3	24 4	29 4	32 2	32 2	27 2	22 2	12 2	6 1	18 3	14
Mean Daily Maximum Temperature		°F	37 0	42 0	50 0	65 0	76 0	85 0	90 0	90 0	81 0	72 0	54 0	43 0	65 0	14
Mean Daily Minimum Temperature		°C	-8 9	-6 1	-1 7	5 6	12 2	17 8	20 0	19 4	13 9	8 3	0 0	-5 6	6 1	14
Mean Daily Minimum Temperature		°F	16 0	21 0	29 0	42 0	54 0	64 0	68 0	67 0	57 0	47 0	32 0	22 0	43 0	14
Absolute Minimum Temperature		°C	-32 2	-23 9	-23 3	-7 8	-2 2	9 4	11 7	7 8	-0 6	-6 7	-14 4	-23 9	-32 2	14
Absolute Minimum Temperature		°F	-26 0	-11 0	-10 0	18 0	28 0	49 0	53 0	46 0	31 0	20 0	6 0	-11 0	-26 0	14
Mean Number of Days with Maximum Temperature Equal to or Greater than 90°F (32 2°C)		days	0 0	0 0	0 0	0 1	1 8	7 8	16 1	18 5	6 6	1 0	0 0	0 0	51 9	14
Mean Number of Days with Minimum Temperature Equal to or Less than 32°F (0 0°C)		days	29 6	25 0	19 6	6 2	0 1	0.0	0 0	0 0	0 1	2 5	16 9	26.6	126 6	14
[2]Normal Heating Degree Days (Base 65°F/18 3°C)		°C days	625 0	482 0	401 0	168 0	61 0	6 0	0 0	0 0	26 0	134 0	358 0	562 0	2825 0	30
Normal Heating Degree Days (Base 65°F/18 3°C)		°F days	1125 0	868 0	722 0	305 0	110 0	11 0	0 0	0 0	47 0	241 0	645 0	1011 0	5085 0	30
[2]Normal Cooling Degree Days (Base 65°F/18 3°C)		°C days	0 0	0 0	5 0	11 0	65 0	161 0	243 0	231 0	94 0	24 0	0 0	0 0	834 0	30
Normal Cooling Degree Days (Base 65°F/18 3°C)		°F days	0 0	0 0	9 0	20 0	117 0	290 0	437 0	415 0	170 0	43 0	0 0	0 0	1501 0	30
Mean Dew Point Temperature		°C	-8 3	-5 0	-1 7	4 4	12 2	17 2	18 9	17 8	12 8	7 8	0 0	-5 0	6 1	13
Mean Dew Point Temperature		°F	17 0	23 0	29 0	40 0	54 0	63 0	66 0	64 0	55 0	46 0	32 0	23 0	43 0	13
Mean Monthly Precipitation		mm	26 4	24 1	56 9	49 5	105 4	132 1	105 7	78 7	83 3	72 4	27 9	23 4	784 9	14
Mean Monthly Precipitation		in	1 04	0 95	2 24	1 95	4 15	5 20	4 16	3 10	3 28	2 85	1 10	0 92	30 9	14
[2]Absolute Maximum Monthly Precipitation		mm	113 8	59 2	188 0	226 6	261 4	311 9	389 1	295 9	225 2	292 1	101 9	86 4	1533 7	33
[2]Absolute Maximum Monthly Precipitation		in	4 48	2 33	7 40	8 92	10 29	12 28	15 32	11.65	9 89	11 50	4 01	3.40	60 38	33
[2]Absolute Minimum Monthly Precipitation		mm	T	0 51	T	28 2	45 0	7.9	16 3	T	1 5	0 3	0 0	0 8	391 67	33
[2]Absolute Minimum Monthly Precipitation		in	T	0 02	T	1 11	1 77	0 31	0 64	T	0 06	0 01	0 00	0 03	15 42	33
Mean Number of Days with Precipitation Equal to or Greater than 0 1 in (2 54 mm)		days	2 4	2 7	4 9	4 4	6 5	7 0	6.4	4 2	5 4	4 2	2 6	2 9	53 6	14
Mean Number of Days with Thunderstorms		days	0 1	0 9	2 4	4 7	8 6	11 1	9 4	6 3	6.7	3 8	1 0	0 3	55 3	14
Mean Monthly Snowfall		mm	129 5	99 1	134 6	10 2	0 0	0 0	0 0	0 0	0 0	0 0	25 4	114 3	513 1	14
Mean Monthly Snowfall		in	5 1	3 9	5 3	0 4	0 0	0 0	0 0	0 0	0 0	0 0	1.0	4 5	20 2	14
[2]Mean Snow Depth		mm	25 0	25 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	25 0	6 25	27
[2]Mean Snow Depth		in	1 0	1 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 0	0 25	27
[2]Absolute Maximum Snow Depth		mm	178 0	279 0	559 0	102 0	0 0	0 0	0 0	0 0	0 0	0 0	203 0	279 0	559 0	27
[2]Absolute Maximum Snow Depth		in	7 0	11 0	22 0	4 0	0 0	0 0	0 0	0 0	0 0	0 0	8 0	11 0	22 0	27
Mean Number of Days with Snowfall Equal to or Greater than 1 5 in (38 1 mm)		days	1 0	0 6	1 2	0 1	0 0	0 0	0 0	0 0	0 0	0 0	0 2	0 9	4 0	14
Mean Percent Relative Humidity		%	72 0	73 0	69 0	63 0	69 0	72 0	69 0	64 0	66 0	66 0	69 0	72 0	69 0	13
Percent Frequency of Surface Wind Speed Equal to or Greater than 28 kts (32 2 mph, 51 9 kmph)		%	0 2	0 2	1 2	1.5	1 0	0 2	0 0	0 0	0 3	0.5	0 1	0 4	0 5	13
Percent Frequency of Surface Wind Speed Equal to or Greater than 17 kts (19 58 mph, 31 5 kmph)		%	5 6	4 7	13 2	14 7	9 8	5 9	4 6	5 2	9 8	9.2	5 8	6 5	7 9	13
Peak Gust		kmph	91 0	81 0	124 0	98 0	117 0	102 0	102 0	87 0	100 0	102 0	109 0	102 0	124 0	13
Peak Gust		kts	49 0	44 0	67 0	53 0	63 0	55 0	55 0	47 0	54 0	55 0	59 0	55 0	67 0	13
Mean Number of Days with Surface Wind Speed Equal to or Greater than 17 kts (19 58 mph, 31 5 kmph) and no Precipitation	at 1800 LST	days	1 3	1 1	4 3	4 4	3 0	2 2	1.5	2 5	2 3	2 0	1 2	1 1	26 9	14
	at 0000 LST	days	1 3	0 7	2 7	4 4	2 5	1 1	1 6	2 3	2.9	2 4	2 0	1 8	25 7	13
	at 0600 LST	days	1 0	1 1	2 8	3 3	1 8	1 0	0 4	0 5	1 3	2 1	0 8	1 8	17 9	14
	at 1200 LST	days	3 0	2 9	5 8	6 5	4 7	2 6	2 4	2 0	4 4	6 1	3 5	3 8	47 7	14
Mean Number of Days with Surface Wind Speed 4-10 kts (4 6-11 5 mph, 7 4-18 5 kmph) and Temperature 33-89°F (0 6-31 7°C) and no Precipitation	at 1800 LST	days	7 8	9 1	12 8	15 6	17 9	15 2	13 6	12 8	17 1	15 8	13 8	10 7	162 2	14
	at 0000 LST	days	4 4	5 0	8 6	11 6	12 6	11 7	11 2	11 4	11 9	10 9	10 5	5 6	115 4	13
	at 0600 LST	days	3 0	3 1	6 2	11.5	14 7	14 1	13 4	13 3	12 7	11 8	8 9	4 4	117 1	14
	at 1200 LST	days	8 6	8 0	11 2	11.9	14 6	15 8	14 4	12 1	14 3	14 5	15 2	9 6	150 2	14
Mean Number of Days with an Occurrence of Visibility Equal to or Less than 0 5 mi (0,8 km)		days	2 4	2 5	2 0	1 0	1 1	0 7	0 8	0 7	1 2	1 1	0 4	2 4	16 3	13
Percent Frequency Ceiling Equal to or Less than 5000 ft (1524 0 m) or Visibility Equal to or Less than 5 mi (8 05 km)		%	27 2	34 0	36 2	23.6	23 8	16 4	12 8	9 7	15 9	16 1	22 1	24 7	21 9	13
Percent Frequency Ceiling Equal to or Less than 1500 ft (457 2 m) or Visibility Equal to or Less than 3 mi (4 828 km)	for 0000-0200 LST	%	17 0	18 0	15 4	7 3	6 6	4.5	1 9	1.2	5 9	6 4	8 8	13 5	8 9	13
	for 0300-0500 LST	%	18 9	19 7	17 2	10 2	10 8	7 5	3 7	3 7	8 4	8 2	11 4	16 1	11 3	13
	for 0600-0800 LST	%	19 7	23.2	20 2	10 5	12 2	10 4	7 2	6 5	12 3	11 5	15 0	17 2	13 8	14
	for 0900-1100 LST	%	19 7	22.7	18 4	9 7	12 6	7 1	4 8	5 1	9 3	9 5	14 9	16 8	12 6	14
	for 1200-1400 LST	%	17 9	19 9	14 5	8 3	6 4	2 1	1 5	2.5	5 3	8 0	10 9	15 6	9 4	14
	for 1500-1700 LST	%	13 7	16 4	14 8	7 9	4 4	1 7	0 9	1 0	4 7	5 9	9 3	11 1	7 7	14
	for 1800-2000 LST	%	13 2	16 4	14 0	6 0	4 5	1.0	0 9	1.1	3 7	5 1	9 1	11.0	7 2	13
	for 2100-2300 LST	%	13 9	17 4	13 4	6 8	4 1	2 8	0 8	1 2	3 6	5 0	8 5	11 3	7 4	13
Percent Frequency Ceiling Equal to or Less than 300 ft (91 4 m) or Visibility Equal to or Less than 1 mi (1 609 km)	for 0000-0200 LST	%	5 3	5 1	0 9	0 9	0 3	1 0	0 3	0.0	0 6	1 5	0 6	3 6	1 7	13
	for 0300-0500 LST	%	5 8	5 8	1 9	2 6	1 6	1 7	1 5	1 1	1 7	0 6	1 7	4 8	2 6	13
	for 0600-0800 LST	%	6 8	6 2	4 0	2 3	1 5	1 3	1 8	1 3	2 8	2 9	2 6	5 8	3 3	14
	for 0900-1100 LST	%	5 9	5 2	2 5	0.5	0 3	0 1	0 1	0.1	0 5	0 4	1 2	4 8	1 8	14
	for 1200-1400 LST	%	3 9	3 2	1 6	0 3	0 1	0 0	0 0	0 0	0 0	0 3	0 6	1 3	0 9	14
	for 1500-1700 LST	%	2 2	2 2	1 9	0 2	0 3	0 1	0 0	0 0	0 0	0 4	0 7	2 2	0 9	14
	for 1800-2000 LST	%	2 5	2 9	2 0	0 0	0 6	0 0	0 3	0 1	0 1	0 3	0 6	3 7	1 1	13
	for 2100-2300 LST	%	2 3	3 6	0 5	0 3	0 0	0 2	0 0	0 0	0 2	1 4	0 8	4 3	1 1	13
Mean Number of Days with Sky Cover Equal to or Less than 30% and Visibility Equal to or Greater than 3 mi (4 828 km)	at 1800 LST	days	11 2	7 0	7 7	6 5	8 8	9 9	13 0	13.9	14 9	15 7	12 0	12 1	132 7	14
	at 0000 LST	days	14 9	11 0	13 4	13 6	13 9	13 2	16 7	18 4	19 0	19 4	17 2	15 6	186 3	13
	at 0600 LST	days	15 7	10 5	9 6	7 7	7 1	6 5	8 5	10 4	14 2	15 2	15 2	16 0	136 6	14
	at 1200 LST	days	10 9	7 1	7 2	7 3	6 6	7 4	9 5	12 6	14 0	14 1	11 3	9 1	117 1	14
Mean Number of Days with Ceiling Equal to or Greater than 1000 ft (304 8 m) and Visibility Equal to or Greater than 3 mi (4 828 km)	at 1800 LST	days	27 8	24 4	27 9	28 8	30 1	29.9	30 9	30 8	29 3	29 9	28 6	28 1	346 5	14
	at 0000 LST	days	27 1	24 1	27 8	28 9	29 6	29 2	30 6	30 7	29 3	29 6	28 4	27 9	343 2	13
	at 0600 LST	days	26 6	23.6	26 9	27 3	28 3	27 9	29 4	29 2	27 5	28 3	26 9	26 6	328 5	14
	at 1200 LST	days	26 3	23 6	28 1	28 4	30 0	29 9	30 6	30 5	29 0	29 5	27 8	27 4	341 1	14
Mean Number of Days with Ceiling Equal to or Greater than 2000 ft (609 6 m) and Visibility Equal to or Greater than 3 mi (4 828 km) and Surface Wind Speed Equal to or Less than 10 kts (11 5 mph, 18 5 kmph)	at 1800 LST	days	19 6	15 8	13 8	12 5	15 5	18 3	18 6	18 4	17 7	20 5	20 3	21 1	212 1	14
	at 0000 LST	days	20 2	17 3	18 0	17 8	19 2	19.9	20 3	19 0	20 2	20 7	20 3	20 7	233 6	13
	at 0600 LST	days	19 0	17 6	16 5	18 1	19 2	21 2	24 6	24 2	20 6	21 6	19 7	21 0	243 3	14
	at 1200 LST	days	12 4	10 2	10 2	8 9	11 9	14 7	18 1	16 0	13 0	12 3	13 0	13 1	153 8	14
Mean Number of Days with Ceiling Equal to or Greater than 2500 ft (762 0 m) and Visibility Equal to or Greater than 3 mi (4 828 km)	at 1800 LST	days	25 2	22 3	24 7	26 6	28 9	29 3	30 2	30 3	28 0	28 5	25 7	26 5	326 2	14
	at 0000 LST	days	24 5	21 4	24 2	27 3	28 1	28 4	30 0	30 4	28.0	28 4	25 4	25 6	321 7	13
	at 0600 LST	days	23 6	20 6	22 7	25 4	25 8	26 5	28 6	28 1	25 7	26 4	23 6	24 7	301 7	14
	at 1200 LST	days	23 8	20.5	23 3	24.8	25 9	27 5	29 4	29 1	26 8	26 7	24 0	24 2	306 0	14
Mean Number of Days with Ceiling Equal to or Greater than 6000 ft (1828 8 m) and Visibility Equal to or Greater than 3 mi (4 828 km)	at 1800 LST	days	23 2	19 6	19 6	22.4	24 0	26 1	28 0	28 0	25 5	25 9	23 3	23 9	289 5	14
	at 0000 LST	days	23 0	18 8	21 0	23.4	24 3	25 4	28.3	28 3	26 1	25.6	23 8	23 2	291 2	13
	at 0600 LST	days	22 3	18 1	18 8	21.7	22 8	23 3	25 6	25 7	23 4	24.2	22 2	23 1	271 2	14
	at 1200 LST	days	22 2	18 0	19 0	21.0	21 0	23 7	25 0	27 2	24 4	24 4	22 1	22 5	270 5	14
Mean Number of Days with Ceiling Equal to or Greater than 10,000 ft (3048 0 m) and Visibility Equal to or Greater than 3 mi (4 828 km)	at 1800 LST	days	22 0	17 6	17 3	20 1	21 8	24.6	25 8	26 5	24 0	24.1	21 9	22 6	268 3	14
	at 0000 LST	days	21 6	17 4	19 5	21 7	21 6	24 0	26 4	27 2	24 7	24 4	22 5	22 4	273 4	13
	at 0600 LST	days	21 2	16 9	16 9	18 7	19 3	20 0	22 0	23 3	21 3	22 4	20 6	21 6	244 2	14
	at 1200 LST	days	20 7	15 9	17 3	18 8	19 1	21 4	22 7	25 3	22 9	23 0	20 7	20 5	248 3	14

[1] T = Trace, LST = Local Standard Time
[2] Data derived from the climatic station at Manhattan, Kansas, about 23 km (14 mi) northwest of Fort Riley/Marshall AAF

TABLE H-2 EPHEMERIS (CENTRAL STANDARD TIME), FORT RILEY

DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET	DATE	NAUTICAL TWILIGHT BEGINNING	NAUTICAL TWILIGHT END	SUNRISE	SUNSET
January 1	0644	1818	0748	1714	March 21	0530	1939	0629	1840	June 11	0344	2109	0458	1955	September 1	0455	1957	0555	1858	November 21	0616	1809	0718	1708
January 11	0645	1825	0748	1722	April 1	0511	1951	0610	1851	June 21	0345	2116	0459	1958	September 11	0504	1942	0604	1842	December 1	0625	1807	0729	1704
January 21	0642	1834	0743	1733	April 11	0455	2003	0555	1901	July 1	0349	2113	0503	1959	September 21	0515	1924	0614	1825	December 11	0634	1808	0738	1703
February 1	0635	1846	0735	1746	April 21	0438	2014	0540	1911	July 11	0357	2108	0509	1955	October 1	0525	1907	0623	1809	December 21	0640	1811	0744	1705
February 11	0627	1857	0726	1757	May 1	0423	2026	0528	1921	July 21	0406	2100	0516	1950	October 11	0535	1852	0633	1753					
February 21	0614	1908	0713	1809	May 11	0409	2039	0517	1930	August 1	0419	2047	0526	1940	October 21	0545	1839	0644	1738					
March 1	0602	1917	0700	1819	May 21	0400	2050	0507	1940	August 11	0430	2032	0536	1928	November 1	0556	1825	0656	1725					
March 11	0546	1928	0644	1830	June 1	0349	2101	0501	1949	August 21	0443	2017	0544	1915	November 11	0606	1815	0707	1715					

I. CROSS-COUNTRY MOVEMENT

MAP UNIT	GENERALIZED TERRAIN CONDITIONS	MOVEMENT OF TRACKED VEHICLES*	MOVEMENT OF WHEELED VEHICLES**	MOVEMENT OF FOOT TROOPS
1	Comprised of Engineering Soils Map Units 2, 3, 4, 5, and 6. Soils mainly silty clays (ML) and lean clays (CL) usually lying over lean clays (CL) to fat clays (CH). Depth of surface soils varies from 15 to 30 cm (6 to 12 in.). The predominant soil is 30 cm (12 in.) of lean clay (CL) or fat clay (CH), with depth to bedrock >1.2 m (>4.2 ft). The predominant soil is shown as Unit 5 on the Engineering Soils Map. Topography is gently rolling. Average slope, 3 percent; maximum slope, 8 percent. Tall grasses (Vegetation Map Unit 5) cover the area.	Unrestricted at all times.	Unrestricted at all times.	Unrestricted at all times.
2	Coincides with Engineering Soils Map Unit 7. Consists of well-drained, sloping to moderately steep upland silty clay (ML) to lean clay (CL) soils that are shallow to bedrock. Slopes range from 5 to 20 percent but usually are between 6 and 12 percent. The vegetation is tall grasses (Vegetation Map Unit 5) for the most part, but the lower ends of the slopes may contain some scrub and trees.	Unrestricted at all times.	Generally unrestricted except for minor slipping on steepest slopes when soils are wet.	Unrestricted at all times.
3	Coincides with that portion of Engineering Soils Map Unit 1 not occupied by trees. Consists of floodplains along upper reaches of drainageways. Soils, which are subject to flooding, vary from fine sand (SP) to silty clay (ML). Slopes are generally below 6 percent but some areas in the Breaks–Alluvial soil series near the extreme upper reaches of the drainageways contain small patches in which slopes may be up to 50 percent. The streams associated are mainly ephemeral; a few are seasonal. The configuration of the streambeds is considerably less severe than in CCM Map Unit 4. Predominant vegetation is tall grass (Vegetation Map Unit 5).	Except at times of flooding, immobilizations are not likely to occur. Movement in the wet period is somewhat degraded due to slippery slopes.	Except at times of flooding, immobilizations are not likely to occur. Movement in the wet period is noticeably more difficult due to slippery slopes.	Unrestricted except when flooded.
4	Coincides with that portion of Engineering Soils Map Unit 1 occupied by medium to densely spaced trees (Vegetation Map Unit 1). Consists of floodplains along lower reaches of deeply-incised perennial, seasonal, and ephemeral streams. Soils, which are subject to flooding, vary from fine sand (SP) to silty clay (ML). Slopes are generally below 6 percent. The dominant feature of this unit from a CCM standpoint is the shape of the stream cut. In general, the walls of the stream cut are nearly vertical and more than 2 m (6.6 ft) high.	Based primarily on the severe U-shaped cross section of the drainageways, which prohibits crossings except at a few selected locations, the unit is considered unsuited for tracked vehicles.	Based primarily on the severe U-shaped cross section of the drainageways, which prohibits crossings except at a few selected locations, the unit is considered unsuited for wheeled vehicles.	Troops are slowed down crossing the streams and in the wooded floodplains. During flooding periods, troop movement would not be practicable.
5	Coincides with Engineering Soils Map Unit 8. Consists of steep, stony valley walls along major streams. The soils are generally shallow silty to lean clays (ML to CL), many with chert fragments. Many bedrock outcrops occur, sometimes forming shear vertical faces more than 1 m (3 ft) in height. The slopes range from 20 to 60 percent, but most fall within 30 to 50 percent. The vegetation varies widely; trees grow where the soils are deep, grasses where the soils are shallow.	The steepness of the slopes and the roughness of the surface together effectively prohibit the movement of tracked vehicles.	The steepness of the slopes and the roughness of the surface together effectively prohibit the movement of wheeled vehicles.	Somewhat restricted by steep slopes and rough surface.

* Comments apply to the M-60 tank and the M-113 armored personnel carrier (APC).

**Comments apply to the M-35, 2-1/2 ton truck and M-151, 1/4 ton truck.

GENERAL NOTES

The dry, hot days of the summer create conditions conducive to dust formation even in areas where vegetation might be expected to hold the soil surface intact. The passage of a vehicle crushes the grass and shears a thin layer of dry soil (dust) from the surface. This condition is aggravated by repetitive traffic. The dust conditions are particularly bad on the many tank trails. Dust conditions are not restricted to normal dry periods but can also occur following long rainless stretches in the wet period.

In the wet period, the off-road soil strength is seldom reduced to the point that it is inadequate for the subject vehicles, even under repetitive traffic. Exceptions to this occur during and following flooding conditions (Map Units 3 and 4) and anywhere water has remained trapped for several days. The latter occurrence is infrequent, easily recognizable, and readily avoided. The tank trails, unless regularly maintained by engineer effort, are often more difficult to traverse (especially by wheeled vehicles) than most adjacent areas, e.g., Map Units 1 and 2, because the low spots in the trails remain covered by water. Sometimes such spots can only be crossed by wheeled vehicles traveling at high speeds. Positive vehicle control may be lost in such situations. Occasionally, the spots are bad enough to cause vehicle breakdowns.

Frozen soil conditions provide no difficulty for vehicles under most off-road conditions. Snow depth greater than about 20 cm (8 in.) cannot be negotiated by the M-151; snow depths greater than 30 cm (12 in.) will usually immobilize the M-35. The tracked vehicles will seldom encounter snow deep enough to prohibit their movement.

FORT RILEY, KANSAS
TERRAIN ANALYSIS

CROSS-COUNTRY MOVEMENT

MAP UNIT	TERRAIN UNIT	PREDICTED MOVEMENT RATINGS FOR									
		TANK (M-60)		APC (M-113)		2½-TON TRUCK (M-35)		¼-TON TRUCK (M-151)		FOOT TROOPS	
		PERIOD		PERIOD		PERIOD		PERIOD		PERIOD	
		DRY*	WET**	DRY	WET	DRY	WET	DRY	WET	DRY	WET
1	Gently rolling grasslands	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
2	Moderately steep uplands	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
3	Narrow floodplains in upper reaches of drainageways	Good	Good	Good	Good	Good	Fair	Good	Fair	Good	Good
4	Narrow floodplains in lower reaches of drainageways	Unsuited		Unsuited		Unsuited		Unsuited		Fair	Fair
5	Steep valley walls along major streams	Unsuited		Unsuited		Unsuited		Unsuited		Fair	Fair
	Open areas; mainly built-up areas and associated features and facilities	Not Evaluated									

Impact area boundary (Cross-country movement in impact area is prohibited due to the danger of unexploded ammunition).

NOTE

Cross-country movement is defined as the off-road movement of military vehicles and personnel. The principal areal features that contribute to the cross-country movement rating of a terrain unit are soil type, state of ground (wet, dry, frozen), slope, vegetation, surface shape (rough, smooth, furrowed), and lakes and reservoirs. The principal linear features that affect cross-country movement are railroad and highway cuts and fills and rivers and streams. Natural and man-made features such as boulders, escarpments, and structures of all kinds also affect cross-country movement. The movement of different vehicles on the same terrain may be radically different, ranging from unable to travel for one vehicle to able to travel easily for another vehicle. The same terrain may afford different cross-country movement to the same vehicle at different times, depending, for example, on the time elapsed since the last rainfall. Driver skill and mechanical condition of the vehicle also can affect cross-country movement.

This map is primarily intended as a tool for the formulation of military stationing plans such as the relocation of a large unit or the selection of training areas. It is not intended to be the sole source for the selection of specific off-road routes for vehicles or personnel, but is a good base from which to plan additional study and ground reconnaissance for that purpose.

EXPLANATION OF RATING TERMS

Good Conditions permit free movement in any direction. Terrain will permit 12 or more passes in trace of an M-60 tank or permit at least one maneuver (starts, stops, sharp turns, or crossing of tracks) at one location.

Fair Conditions moderately hinder progress or moderately restrict choices of direction for movement. Terrain will permit 3 to 12 passes in trace of an M-60 but maneuvering will be difficult.

Poor Conditions severely hinder progress or greatly restrict choice of movement routes. Terrain will probably permit up to 3 passes in trace of an M-60. Very cautious driving required. Movement in trace should be avoided.

Unsuited Conditions preclude all but local movement. Engineer work required for vehicular movement.

The data on terrain factors examined and the cross-country movement evaluations resulting were necessarily generalized to suit the scale and purpose of the map. Thus an area marked with a specific rating may contain areas, too small to be mapped, that have better or worse ratings. However, the significant occurrence of such cases is noted in the description of generalized terrain conditions.

The cross-country movement ratings were assigned on the basis of normal weather in the specified period, i.e., the ratings apply to most of the days in that period. Variations in the ratings for relatively short periods may occur from year to year or even within the same specified period because of unusual weather such as prolonged periods of drought, heavy precipitation, or freezing temperatures.

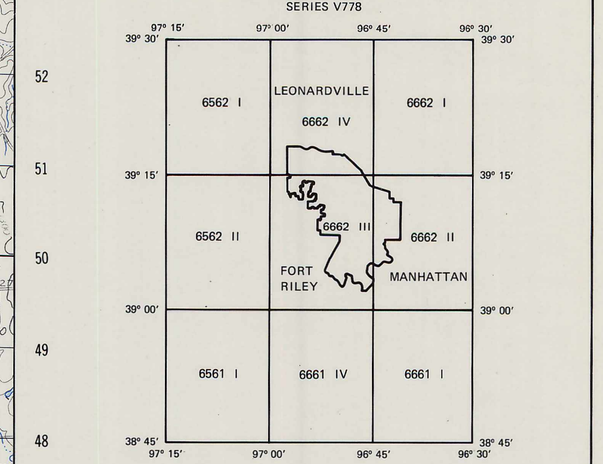
EXPLANATION OF WET AND DRY PERIODS

*Dry Period - The period when soil moisture is relatively low and the water table has been lowered by actively growing vegetation. In most years this period extends from April through November. Unusual climatic variations may drastically alter this time period.

**Wet Period - The period when soil moisture is relatively high and the water table is raised. In most years this period extends from about December through mid-April. Wet periods, generally of short duration, may occur occasionally at other times of the year.

NOTE: In some units at Fort Riley, the CCM rating in the dry and wet periods is judged to be the same for the same vehicle. One reason for this is that the reduction in soil strength that inevitably occurs in wet periods is not sufficient to lower the strength to a value that is critical for the vehicle. This was demonstrated during an actual vehicular test conducted at Fort Riley during May of 1977 as a part of the data gathering process for CCM. The test was conducted with all four subject vehicles immediately following a four day stormy period that saturated the soil with five inches of rain. Despite this the cross-country movement of the tested vehicles, in most places, was not seriously impaired. Another consideration, however, is that improved visibility in the wet period (no dust created by traffic and a lower density of grasses and leaves) occurs at the expense of some loss of vehicle control on wet slippery surfaces. Thus, while seasonal changes may not affect the final CCM rating of a unit, it is well to remember that they do influence the specific driving conditions.

1:50,000 SHEET INDEX
SERIES V778



Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

J. LINES OF COMMUNICATION

Lines of Communication (LOC) at Fort Riley are depicted on the accompanying LOC map. Supportive information for LOC as shown on the graphic is provided in Tables J-1 through J-8 following this summary.

ROADS: The existing road network is a complex system of routes spanning a range of categories from all weather, hard surfaced to fair weather, improved dirt roads. The roads shown on the map do not represent the complete network; many of the new dirt roads do not appear on the latest U.S. Geological Survey map sheets nor do they appear on available aerial photography. The total length of all roads included on the map is approximately 511 kilometers (317.5 miles). Hard surface roads, all of which are shown on the map, total approximately 143 kilometers (88.8 miles). The length of the entire system is unknown and will vary from year to year principally because of construction or abandonment of dirt roads. Refer to Table J-1, Roads, for individual road details. Data on military load classification and most road shoulder characteristics are not available.

ROAD BRIDGES: There are several road bridges within the installation boundaries. All bridges have been evaluated by the military load classification system. Table J-2, Road Bridges, provides available details pertaining to each bridge.

RAILROADS AND RAILROAD BRIDGES: Federally owned track is limited to sidings that service the supply warehouse area. Total length of the entire railroad system is 12.0 kilometers (7.4 miles) with a volume of traffic of approximately 45 cars per month being delivered to Fort Riley while approximately 500 cars per day are carried over the non-federally owned track. There are two railroad bridges located on the installation. Tables J-3 and J-4, Railroads and Railroad Bridges, give additional information.

AIRFIELDS/AIRSTRIPS: Located south of the main post, Marshall Army Airfield is the only airfield on the Fort Riley installation. It does not have the operational capability to serve the C-130 transport. There are seven airstrips located within the installation boundaries. See Table J-5, Airfields/Airstrips, for details.

PIPELINES: The pipeline network of Fort Riley consists of six segments, of which five are owned by the Kansas Power and Light Company and the sixth is owned by the National Cooperative Refinery Association. For further information refer to Table J-6, Pipelines.

HELICOPTER LANDING ZONES (HLZs): In addition to the airfields and airstrips which are used for helicopter landings there are sixty designated HLZs. Most HLZs are sod surfaced. Details are given in Table J-7, Helicopter Landing Zones.

DROP ZONES: There is only one designated drop zone at Fort Riley, and it is classified inactive, since it lies in the new tank gunnery range. An alternate drop zone has been proposed by the installation, but it has not yet been approved.

TABLE J-1

ROADS

ROUTE NUMBER/ NAME	ROUTE LOCATION (GRID REFERENCE) FROM	TO	LENGTH OF SEGMENT	MILITARY LOAD CLASSIFICATION	ROUTE TYPE	SURFACE CONSTRUCTION MATERIALS	SURFACE WIDTH/CONDITION	SHOULDERS CONSTRUCTION MATERIALS	SHOULDERS WIDTH/CONDITION	REMARKS
Anzio Road	879264	905260	2.5 km (1.6 mi)	No data	All weather	Asphalt	6.9 m (22.6 ft); good	Crushed stone	No data	
Caisson Hill Road	914297	926274	2.7 km (1.7 mi)	No data	All weather	Asphalt	7.0 m (23.0 ft); good	Crushed stone	2 m (6.6 ft); good	
Campbell Hill Road	949336	952302	3.5 km (2.2 mi)	No data	All weather	Asphalt	6.5 m (21.3 ft); good	Crushed stone	1 m (3.3 ft); good	
Engineer Road	971337	973432	10.5 km (6.5 mi)	No data	All weather	Asphalt	6.9 m (22.6 ft); good	Crushed stone	.67 m (2.2 ft); No data	
Henry Drive	922256	934233	2.5 km (1.6 mi)	No data	All weather	Asphalt	7.6 m (24.9 ft); No data	Asphalt	No data	
Huebner Road	901257	975316	10 km (6.2 mi)	No data	All weather	Asphalt	7.1 m (23.3 ft); good	Crushed stone	1 m (3.3 ft); good	
K 82	760430	785526	12.5 km (7.8 mi)	No data	All weather	Asphalt	No data	No data	No data	
Junction City Boulevard	879264	879237	2.5 km (1.6 mi)	No data	All weather	Asphalt	No data	Crushed stone	No data	
Mallon Road	971337	974315	2.5 km (1.6 mi)	No data	All weather	Asphalt	6.9 m (22.6 ft); good	Crushed stone	No data	
No Name Road	849275	869266	2.4 km (1.5 mi)	No data	All weather	Asphalt	6.9 m (22.6 ft); No data	Stone	1 m (3.3 ft); No data	
Normandy Drive	886303	906295	2 km (1.2 mi)	No data	All weather	Asphalt	No data	Crushed stone	No data	
Old K 82/Old County Road										
Segment 1	977436	805433	17.5 km (10.9 mi)	No data	All weather	Asphalt	6.8 m (22.3 ft); No data	Grass	1 m (3.3 ft); fair	
Segment 2	784438	795433	1.5 km (.9 mi)	No data	All weather	Asphalt	No data	No data	No data	
Old U.S. 77/ 9th Division Rd.	871512	862306	21 km (13.0 mi)	No data	All weather	Asphalt	6.8 m (22.3 ft); good	Crushed stone	.67 m (2.2 ft); fair	
Range Road/ Richardson Rd.	904335	919432	11.25 km (7.0 mi)	No data	All weather	Asphalt	7.1 m (23.3 ft); good	Crushed stone	1 m (3.3 ft); fair	
Trooper Drive	879264	886303	4.5 km (2.8 mi)	No data	All weather	Concrete	7.1 m (23.3 ft); good	Asphalt	1 m (3.3 ft); good	
US 77										
Segment 1	785526	792414	11.5 km (7.2 mi)	No data	All weather	Asphalt	No data	Crushed stone	No data	
Segment 2	809406	813391	1.5 km (.9 mi)	No data	All weather	Asphalt	No data	Crushed stone	No data	
Segment 3	845273	844266	.55 km (.3 mi)	No data	All weather	Asphalt	No data	Crushed stone	No data	
Vinton School Road	875335	971337	10 km (6.2 mi)	No data	All weather	Asphalt	7.0 m (23 ft); good	Crushed stone	1 m (3.3 ft); fair	
Williston Point Road	906295	951301	5 km (3.1 mi)	No data	All weather	Asphalt	6.8 m (22.3 ft); good	Crushed stone	.67 m (2.2 ft); fair	
1st Division Road	904335	917267	7.5 km (4.7 mi)	No data	All weather	Asphalt	6.9 m (22.6 ft); good	Crushed stone	1 m (3.3 ft); good	

ADDITIONAL INSTALLATION ROUTES (UNNAMED)

CATEGORY	TOTAL LENGTH (Approximate)
Tank trails	111.5 km (69.3 mi)
1 lane loose surface road	215 km (133.6 mi)
Improved dirt road	153 km (95 mi)

TABLE J-2

ROAD BRIDGES

BRIDGE NUMBER	ROUTE NAME/ NUMBER	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION*	DIMENSIONS	CLEARANCE	TYPE/CONSTRUCTION MATERIALS	CONDITION	REMARKS
1	Unnamed road	765510	Unnamed stream	60	9.7 m (32 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	Deck; concrete T-beam	No data	
2	Unnamed road	798478	Dry Creek	16	4.9 m (16 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	No data	No data	
3	Old County Road/ Old K82	815430	Intermittent stream	20	9.1 m (30 ft) long; overall width-no data; roadway width 6.1 m (20 ft)	Unlimited vertical; horizontal no data	Deck; timber deck, steel stringer	No data	
4	Unnamed road	887496	Wildcat Creek	7	7.3 m (24 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	Deck; timber deck, steel stringer	No data	
5	Unnamed road	889495	Wildcat Creek	6	9.1 m (30 ft) long; overall width-no data; roadway width 5.5 m (18 ft)	Unlimited vertical; horizontal no data	Deck; timber deck, steel stringer	No data	
6	Unnamed road	921472	Wildcat Creek	15	15.8 m (52 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	Deck; concrete slab	No data	
7	Unnamed road	927456	Wildcat Creek	10	9.8 m (32 ft) long; overall width-no data; roadway width 3.6 m (12 ft)	Unlimited vertical; horizontal no data	Deck; steel truss	No data	
8	Unnamed road	920451	Wind Creek	50	7.3 m (24 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	Deck; simple span concrete slab	No data	
9	Unnamed road	905442	Wind Creek	80	6.1 m (20 ft) long; overall width-no data; roadway width 3.6 m (12 ft)	Unlimited vertical; horizontal no data	No data	No data	
10	Old County Road/ Old K82	969432	Honey Creek	85	22.5 m (74 ft) long; overall width-no data; roadway width 6.1 m (20 ft)	Unlimited vertical; horizontal no data	Deck; concrete deck, steel stringer	No data	
11	Old County Road/ Old K82	977433	Wildcat Creek	20	21.9 m (72 ft) long; overall width-no data; roadway width 6.1 m (20 ft)	Unlimited vertical; horizontal no data	Deck; steel truss	No data	
12	Unnamed road	836382	Intermittent stream	50	7.3 m (24 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	Deck; steel stringer	No data	
13	Unnamed road	835342	Rush Creek	15	9.7 m (32 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	Deck; steel truss	No data	
14	Vinton School Road	897335	Intermittent stream	16	3.6 m (12 ft) long; overall width-no data; roadway width 3.6 m (12 ft)	Unlimited vertical; horizontal no data	Deck; concrete deck, steel stringer	No data	
15	Vinton School Road	926336	Threemile Creek	15	12.2 m (40 ft) long; overall width-no data; roadway width 3.6 m (12 ft)	Unlimited vertical; horizontal no data	Deck; timber deck, steel stringer	No data	
16	Vinton School Road	932335	Threemile Creek	16	10.9 m (36 ft) long; overall width-no data; roadway width 4.9 m (16 ft)	Unlimited vertical; horizontal no data	No data	No data	
17	Huebner Road	975316	Intermittent stream	100	11.6 m (38 ft) long; overall width-no data; roadway width 8.8 m (29 ft)	Unlimited vertical; horizontal no data	Deck; concrete/steel	No data	
18	L Street	968308	Union Pacific Railroad	32	123.7 m (406 ft) long; overall width-no data; roadway width 8.5 m (28 ft)	Unlimited vertical; horizontal no data	Deck; concrete deck	No data	
19	Leonard Wood Drive	961304	Union Pacific Railroad	32	122.5 m (402 ft) long; overall width-no data; roadway width 8.5 m (28 ft)	Unlimited vertical; horizontal no data	Deck; concrete deck	No data	

TABLE J-2 (Continued)

ROAD BRIDGES

BRIDGE NUMBER	ROUTE NAME/ NUMBER	GRID REFERENCE	FEATURE CROSSED	MILITARY LOAD CLASSIFICATION*	DIMENSIONS	CLEARANCE	TYPE/CONSTRUCTION MATERIALS	CONDITION	REMARKS
20	Well House Road	955292	Threemile Creek	7	17 7 m (58 ft) long, overall width-no data, roadway width 3 6 m (12 ft)	Unlimited vertical, horizontal no data	Deck, timber deck, military truss	No data	
21	None	949298	Threemile Creek	60	15 2 m (50 ft) long, overall width-no data, roadway width 3 0 m (9 8 ft)	Unlimited vertical, horizontal no data	Deck, wood deck, steel stringer	No data	Used also as foot bridge
22	Huebner Road	949298	Threemile Creek	60	15 8 m (52 ft) long, overall width-no data, roadway width 9 1 m (30 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
23	Huebner Road	926273	Intermittent stream	60	8 8 m (29 ft) long, overall width-no data, roadway width 7 6 m (25 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	Presently being expanded
24	Henry Drive	922256	Union and Pacific Railroad	63	80 5 m (264 ft) long, overall width-no data, roadway width 9 7 m (32 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
25	Henry Drive	924249	Kansas River	68	285 5 m (937 ft) long, overall width-no data, roadway width 9 7 m (32 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
26	Huebner Road	904259	Anzio Road	58	34 7 m (112 ft) long, overall width-no data, roadway width 8 5 m (28 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
27	Huebner Road	902256	Republican River	60	89 6 m (294 ft) long, overall width-no data, roadway width 6 1 m (20 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
28	Huebner Road	901256	Republican River	60	16 m (52 5 ft) long, overall width-no data, roadway width 8 5 m (28 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
29	Huebner Road	905261	Intermittent stream	60	9 1 m (30 ft) long, overall width-no data, roadway width 7 9 m (26 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
30	Junction City Blvd	879251	Dirt trail	17	15 2 m (50 ft) long, overall width-no data, roadway width 8 5 m (28 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	
31	US 77	846266	Republican River	45	350 2 m (1,149 ft) long, overall width-no data, roadway width 7 3 m (24 ft)	Unlimited vertical, horizontal no data	Deck, concrete	No data	

*Unsubstantiated data Unknown, wheeled or track, one-way or two-way Use only for comparative purposes

TABLE J-3

RAILROADS

IDENTIFICATION NUMBER	SEGMENT OF TRACK (GRID REFERENCES)	LENGTH OF SEGMENT	OWNERSHIP OF LINE AND CONDITION OF TRACK	CHARACTERISTICS OF TRACKS	CROSS-OVER LOCATIONS	SIDINGS (GRID REFERENCES)	BALLAST MATERIAL	VOLUME OF TRAFFIC	FACILITIES	REMARKS
1	902256-918254	2 km (1 2 mi)	Union Pacific, good condition	Standard gage, single track, weight of rail 178 kg/m (393 lbs/yd) Grade less than 3%, minimum radius of curvature-no data	None	None	Sherman Hill Rock	Fort Riley 45 cars/month, through 500 cars/day	None	Freight service only
2	918254-972310	8 2 km (5 1 mi)	Union Pacific, good condition	Standard gage, double track, weight of rail 178 kg/m (393 lbs/yd), 4 3 m (14 ft) spacing Grade less than 3%, minimum radius of curvature-no data	None	2 km (1 2 mi), from 955301-972310 1 0 km (6 mi), from 956301-960292 1 2 km (8 mi), from 972310-974299 2 km (1 mi), from 971300-973302	Sherman Hill Rock	Fort Riley 45 cars/month, through 500 cars/day	Station, Grid Reference 923257	Freight service only
3	929268-936285	2 km (1 2 mi)	U S Government, good condition	Standard gage, double track, weight of rail 178 kg/m (393 lbs/yd), spacing-no data Grade less than 3%, minimum radius of curvature-no data	None	None	Sherman Hill Rock	45 cars/month	None	U S Government owned siding services, supply warehouse areas
4	972310-978313	6 km (4 mi)	Union Pacific, good condition	Standard gage, single track, weight of rail 178 kg/m (393 lbs/yd) Grade less than 3%, minimum radius of curvature-no data	None	None	Sherman Hill Rock	Fort Riley 45 cars/month, through 500 cars/day	None	Freight service only

TABLE J-4

RAILROAD BRIDGES

IDENTIFICATION NUMBER	LOCATION (GRID REFERENCE)	FEATURE CROSSED	NUMBER OF TRACKS	ROADWAY WIDTH	CLEARANCE		DECK MATERIAL	OVERALL LENGTH	TYPE OF STRUCTURE	REMARKS
					HORIZONTAL	VERTICAL				
1	902256	Republican River	Single	6 1 m (20 ft)	6 1 m (20 ft)	7 3 m (24 ft)	Wood	61 m (200 ft)	Steel	
2	949298	Threemile Creek	Single	12 2 m (40 ft)	12 2 m (40 ft)	Unlimited	Wood/steel	18 3 m (60 ft)	Timber trestle	

TABLE J-5

AIRFIELDS/AIRSTRIPS

MAP NUMBER/NAME, GRID REFERENCE, TYPE, CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
1/Marshall AAF, 935250, Army, Airfield	324 6 m (1,065 ft) Operational	Longest runway 1,371 6 m long, 45 7 m wide (4,500 ft long, 150 ft wide), azimuth, 360°-180°, maximum weight bearing capacity—S 12, T 21, concrete surface in fair condition Runway 2 1,371 6 m long, 45 7 m wide (4,500 ft long , 150 ft wide), azimuth, 040°-220°, maximum weight bearing capacity—S 12, T 21, concrete surface in fair condition	Four taxiways 22 9 x 350 m (75 x 1,148 3 ft), 22 9 x 450 m (75 x 1,476 4 ft), 22 9 x 500 m (75 x 1,640 4 ft), 22 9 x 600 m (75 x 1,968 5 ft) Maximum weight bearing capacity of all taxiways is the same as longest runway, concrete surfaces One parking apron, surface area totals 50,074 7 m^2 (539,000 ft^2), maximum weight bearing capacity same as longest runway, concrete surface	Four hangars 45 7 x 38 1 x 7 6 m (150 x 125 x 25 ft), 45 7 x 45 7 x 12 2 m (150 x 150 x 40 ft), 45 7 x 45 7 x 12 2 m (150 x 150 x 40 ft) First two hangars have brick construction Hangars one, two, and four have shops incorporated into the hangar Field Operations Bldg #839, 11,148 4 m^2 (120,000 ft^2) floor space Other important buildings, Unit Operations Bldg #863, BN HQ Bldg #355, Synthetic Trainer Bldg #860	Grades of fuel U S Aviation Fuel (MIL-SPECS) 100/130, JP-4 Underground storage tanks, mobile dispensing facilities, total storage capacity 378,541 2 liters (100,000 gal)	Control tower, 320 0 m (1,060 ft) above sea level and 16 8 m (55 ft) high Omnidirectional radio range (VOR-VHF), non-directional radio beacon, ground controlled approach Lights, airfield lighted for fixed wing aircraft	Current approaches slightly restricted by Manhattan Airport. Any future expansion of Manhattan Airport will result in further restrictions
2/969332, Army, Airstrip	353 6 m (1,160 ft) Operational	Longest runway 300 m long, 50 m wide (984 ft long, 165 ft wide), azimuth, 100°-280°, weight bearing capacity—no data, grass surface, condition-no data Runway 2 200 m long, 50 m wide (656 ft long, 165 ft wide), azimuth, 360°-180°, weight bearing capacity--no data, grass surface, condition—no data	None	None	None	None	
3/998373, Army, Airstrip	341 4 m (1,120 ft) Operational	400 m long, 25 m wide (1,312 ft long, 82 ft wide), azimuth, 090°-270°, weight bearing capacity—no data, grass surface, condition—no data	None	None	None	None	
4/983389, Army, Airstrip	402 3 m (1,320 ft) Operational	250 m long, 25 m wide (820 ft long, 82 ft wide), azimuth, 015°-195°, weight bearing capacity—no data, grass surface, condition—no data	None	None	None	None	
5/985414, Army, Airstrip	396 2 m (1,300 ft) Operational	250 m long, 25 m wide (820 ft long, 82 ft wide), azimuth, 155°-335°, weight bearing capacity—no data, grass surface, condition—no data	None	None	None	None	
6/878389, Army, Airstrip	402 3 m (1,320 ft) Operational	650 m long, 25 m wide (2,132 5 ft long, 82 ft wide), azimuth, 179°-359°, weight bearing capacity—no data, grass surface, condition—no data	None	None	None	None	

J. LINES OF COMMUNICATION (Continued)

TABLE J-5 (Continued)
AIRFIELDS/AIRSTRIPS

MAP NUMBER/NAME; GRID REFERENCE; TYPE; CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION	TAXIWAY, PARKING APRON, HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES	NAVIGATIONAL AIDS	REMARKS
7/883337; Army; Airstrip	390.1 m (1,280 ft) Operational	350 m long; 25 m wide (1,148 ft long; 82 ft wide); azimuth, 065°-245°; weight bearing capacity—no data; grass surface, condition—no data.	None	None	None	None	
8/898415; Army; Airstrip	414.5 m (1,360 ft) Operational	1,050 m long; 50 m wide (3,444.9 ft long;164 ft wide); azimuth, 045°-225°; weight bearing capacity—no data; grass surface, condition-no data.	None	None	None	None	Air Force personnel considering this airstrip as possible landing site for C-130.

NOTE: Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to pound figure following S, T. Runway weight bearing capacity given is for unlimited operations. Aircraft weight, higher than given, requires prior permission from aerodrome controlling authority.

S - Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F-100).

T - Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-9A).

For further information, see DOD Flight Information Publication (Enroute IFR Supplement United States).

TABLE J-6
PIPELINES

MAP NUMBER	REFERENCE FROM	REFERENCE TO	STATUS	OWNERSHIP	PIPELINE CHARACTERISTICS	TANK CROSSING SITES	REMARKS
1	871249	884266	Operative	Kansas Power & Light	Diameter of pipe: 20.3 cm (8 in.); total length of pipeline: 2.5 km (1.6 mi); material normally carried: natural gas; rated capacity: no data; actual throughput: no data.	No data	
2	846272	884266	Operative	Kansas Power & Light	Diameter of pipe: 30.5 cm (12 in.); total length of pipeline: 4 km (2.5 mi); material normally carried: natural gas; rated capacity: no data; actual throughput: no data.	No data	
3	884266	921270	Operative	Kansas Power & Light	Diameter of pipe: 25.4 cm (10 in.); total length of pipeline: 3.5 km (2.2 mi); material normally carried: natural gas; rated capacity: no data; actual throughput: no data.	No data	
4	921270	978312	Operative	Kansas Power & Light	Diameter of pipe: 20.3 cm (8 in.); total length of pipeline: 7.6 km (4.7 mi); material normally carried: natural gas; rated capacity: no data; actual throughput: no data.	No data	
5	902257	977313	Operative	Kansas Power & Light	Diameter of pipe: 20.3 cm (8 in.); total length of pipeline: 10 km (6.2 mi); material normally carried: natural gas; rated capacity: no data; actual throughput: no data.	No data	
6	759500	772527	Operative	National Cooperative Refinery Association	Diameter of pipe: 15.2 cm (6 in.); total length of pipeline: 3.0 km (1.9 mi); material normally carried: gasoline & kerosene; rated capacity: 115.3 m^3/hr (4,070.8 ft^3/hr); actual throughput: 115.3 m^3/hr (4,070.8 ft^3/hr).	No crossing restrictions due to depth of buried pipe.	Pipe buried approximately 2.4 m (8 ft).

TABLE J-7
HELICOPTER LANDING ZONES

MAP NUMBER AND/OR NAME	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE MATERIAL	RESTRAINTS	REMARKS
1/Special Services Beach	770416	No data	No data	365.8 m (1,200 ft)	Sand	No data	Medevac only
2/Special Services Boat Docks	759420	No data	No data	359.7 m (1,180 ft)	Sand	No data	
3	816386	No data	No data	365.8 m (1,200 ft)	Sod	Unlit tower 30.5 m (100 ft) above ground level	
4/TF1	911358	No data	No data	402.3 m (1,320 ft)	Sod	No data	
5/TF2	901372	No data	No data	402.3 m (1,320 ft)	Sod	Wires on north and west are marked	
6/TF3	897396	No data	No data	396.2 m (1,300 ft)	Sod	Wires on south side	
7/TF4	895401	No data	No data	402.3 m (1,320 ft)	Sod	Building on north side	
8/TF5	896407	No data	No data	408.4 m (1,340 ft)	Sod	Wires on north and west and marked	
9/RN#16	935339	No data	No data	347.5 m (1,140 ft)	Sod	No data	"H" painted red
10/RN#17	939343	No data	No data	365.8 m (1,200 ft)	Sod	No data	
11/RN#19	932343	No data	No data	347.5 m (1,140 ft)	Sod	No data	
12/RN#20	912358	No data	No data	402.3 m (1,320 ft)	Sod	No data	
13/RN#29	977396	No data	No data	408.4 m (1,340 ft)	Sod	No data	
14/RN#34	929336	No data	No data	341.4 m (1,120 ft)	Sod	No data	
15/RN#51	931428	No data	No data	384.0 m (1,260 ft)	Sod	No data	
16/RN#52	946428	No data	No data	384.0 m (1,260 ft)	Sod	No data	
17/#1 Helipad	889306	No data	No data	402.3 m (1,320 ft)	Sod	No data	
18/#2 Helipad	891315	No data	No data	402.3 m (1,320 ft)	Sod	No data	
19/#3 Helipad	896313	No data	No data	402.3 m (1,320 ft)	Sod	No data	Closed
20	998360	No data	No data	329.2 m (1,080 ft)	Sod	No data	Confined area
21	001400	No data	No data	359.7 m (1,180 ft)	Sod	No data	Confined area
22	979418	No data	No data	365.8 m (1,200 ft)	Sod	No data	Confined area
23	999414	No data	No data	365.8 m (1,200 ft)	Sod	No data	Pinnacle
24	999406	No data	No data	396.2 m (1,300 ft)	Sod	No data	Pinnacle
25	988378	No data	No data	396.2 m (1,300 ft)	Sod	No data	Pinnacle
26	988344	No data	No data	365.8 m (1,200 ft)	Sod	No data	Slope
27	988355	No data	No data	359.7 m (1,180 ft)	Sod	No data	Slope
28	979397	No data	No data	390.1 m (1,280 ft)	Sod	No data	Slope
29/HQ's Helipad	918272	No data	No data	402.3 m (1,320 ft)	Asphalt/concrete	No data	
30/Schofield Circle	920266	No data	No data	384.0 m (1,260 ft)	Sod	No data	Closed

TABLE J-7 (Continued)

HELICOPTER LANDING ZONES

MAP NUMBER AND/OR NAME	LOCATION (GRID REFERENCE)	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE MATERIAL	RESTRAINTS	REMARKS
31/Irwin Hospital	927280	No data	No data	377.9 m (1,240 ft)	Sod	No data	Lighted
32/POW Pad	911248	No data	No data	317.0 m (1,040 ft)	Rock	No data	
33/Funston	961303	No data	No data	323.0 m (1,060 ft)	Sod	No data	
34/Forsyth	877266	No data	No data	335.3 m (1,100 ft)	Asphalt	No data	
35/Packer's Camp RN#12	945301	No data	No data	359.7 m (1,180 ft)	Sod	No data	
36/Slide-for-life	862288	No data	No data	365.8 m (1,200 ft)	Sod	No data	
37/Rappel Tower	860288	No data	No data	365.8 m (1,200 ft)	Sod	No data	
38/TF6	903414	No data	No data	408.4 m (1,340 ft)	Sod	No data	
39/TF7	907415	No data	No data	408.4 m (1,340 ft)	Sod	No data	
40/TF8	911420	No data	No data	408.4 m (1,340 ft)	Sod	No data	
41/TF9	921422	No data	No data	402.3 m (1,320 ft)	Sod	No data	
42/TF10	924424	No data	No data	402.3 m (1,320 ft)	Sod	No data	
43/RN 23/24	964348	No data	No data	353.6 m (1,160 ft)	Sod	No data	
44/RN 25	969355	No data	No data	341.4 m (1,120 ft)	Sod	No data	
45/RN HQ	874343	No data	No data	402.3 m (1,320 ft)	Sod	No data	
46/HQ5	789509	No data	No data	396.2 m (1,300 ft)	Sod	No data	
47/Table 1/2/3	826509	No data	No data	390.1 m (1,280 ft)	Sod & PSP	No data	
48/Table 4	811509	No data	No data	396.2 m (1,300 ft)	Sod & PSP	No data	
49/Table 5	793490	No data	No data	396.2 m (1,300 ft)	Sod & PSP	No data	
50/Table 6	792484	No data	No data	390.1 m (1,280 ft)	Sod & PSP	No data	
51/Table 7/8	792503	No data	No data	396.2 m (1,300 ft)	Sod & PSP	No data	
52/Range 52	956427	No data	No data	365.8 m (1,200 ft)	Sod	No data	
53/Range 53	973422	No data	No data	396.2 m (1,300 ft)	Sod	No data	
54/Range 54	972403	No data	No data	402.3 m (1,320 ft)	Sod	No data	
55/Range 17	940339	No data	No data	365.8 m (1,200 ft)	Sod	No data	
56/Range 18	945338	No data	No data	371.8 m (1,220 ft)	Sod	No data	
57/Range 19	951339	No data	No data	365.8 m (1,200 ft)	Sod	No data	
58/Range 1A	864265	No data	No data	359.7 m (1,180 ft)	Sod	No data	
59/Range 38	862303	No data	No data	365.8 m (1,200 ft)	Sod	No data	
60/Marina	761425	No data	No data	359.7 m (1,180 ft)	Sand	No data	

TABLE J-8

DROP ZONES

MAP NUMBER AND/OR NAME	LOCATION (GRID REFERENCES)	DIMENSIONS	AZIMUTH	ELEVATION	SURFACE DESCRIPTION	AIRCRAFT OBSTRUCTIONS	REMARKS
1/Milford	NE 842437 SE 842431 SW 826431 NW 826437	1,500 m long x 500 m wide (4,921.2 ft long x 1,804.4 ft wide)	090°-270°	396.2 m (1,300 ft)	Grass	No data	This drop zone is located in the new tank gunnery range. It is considered inactive and a replacement drop zone has been proposed.

FORT RILEY, KANSAS
TERRAIN ANALYSIS

LINES OF COMMUNICATION

ROADS

- Hard surface, 2 lanes
- Loose surface, 1 lane
- Improved dirt
- Tank trail
- 77 — Federal route number
- S82 — State route number

BRIDGE DATA
(all measurements in meters)

- A — Bridge number
- B — Military load classification (see footnote of Table J-2 before use)
- C — Roadway width
- D — Length
- E — Vertical clearance
- ∞ — Unlimited vertical clearance

RAILROADS
(all measurements in meters)

- 1 — Single Track, standard gage
- 3 — Multiple Track, standard gage
- Railroad bridge

- A. Bridge number
- B. Vertical clearance
- C. Horizontal clearance
- D. Length

AIRFIELDS/AIRSTRIPS

- 1 — Airfield
- 8 — Airstrip

Orientation of runway is indicated by the placement of airfields or airstrips.

PIPELINES

- 5 — Pipeline

HELICOPTER LANDING ZONES

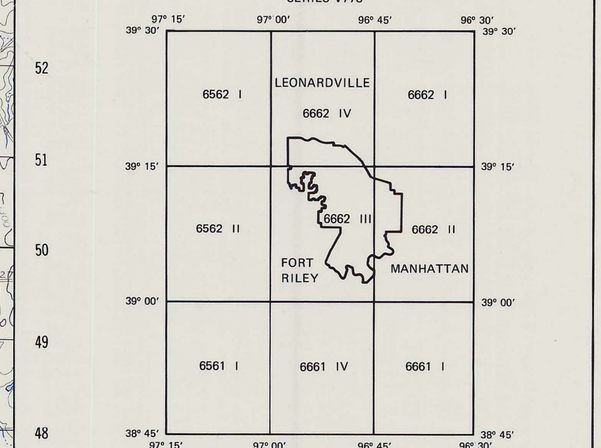
- H 5 — Landing zone

DROP ZONES

- DZ 1 — Drop zone (inactive)

Numbers on map refer to entries in tables.

1:50,000 SHEET INDEX
SERIES V778



Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

K. URBAN AREAS (CANTONMENT AREAS)

TROOP BILLETS

TYPE	TOTAL NUMBER	TOTAL CAPACITY	CURRENT OCCUPANCY	CONDITION	REMARKS
Permanent	46	8,002	6,003	Excellent	Permanent buildings are located in the Custer Hill and Camp Whitside areas and on the Main Post Facilities on the Main Post were constructed between 1889 and 1908 and are being remodeled where necessary Permanent barracks at Camp Whitside and especially Custer Hill have been built since 1959 At the time this study was completed, 13 permanent buildings were under construction at Custer Hill Maximum capacity of all permanent facilities on-post is projected to be 10,172 by 1980 based on 90 square feet per person
Temporary	203	7,474	1,559	Poor to good	Temporary facilities are located at Camp Forsyth, Camp Funston, Camp Whitside, and Marshall Army Airfield Current plans call for the demolition of all the temporary barracks by 1980-1985 A majority of the temporary barracks at Camp Funston and Marshall Airfield are scheduled for demolition during 1977
TOTAL	249	15,476	7,562		All data reflect capacity and load conditions as of May, 1977

QUARTERS

TYPE	NUMBER OF BUILDINGS	TOTAL CAPACITY	CURRENT OCCUPANCY	CONDITION	REMARKS
BOQ					Data presented in the columns to the left represent building classifications as defined by Army Regulation Number 415-28 and published in the *Post Building Directory Fort Riley, Kansas* of March, 1977 Supplemental information on building type and condition was taken from the *Building Information Schedule Fort Riley, Kansas* published in May, 1976
Permanent	10	251	236	9 excellent 1 good	
Temporary	30	309	140	29 poor 1 good	
Transient/Guest					Information on current utilization and occupancy was obtained from Fort Riley engineering and housing personnel Locally obtained data indicates that many BOQ facilities are being utilized as Senior Enlisted Bachelor Quarters (SEBQ) 377 spaces are currently designated for BOQ use while 183 spaces are designated for SEBQ use
Permanent	2	14	8	excellent	
Temporary	6	140	84	poor	Nine of the permanent BOQ buildings are located in the Main Post and Camp Whitside areas and one is located in the Custer Hill Family Housing area One of the buildings on the Main Post is currently being expanded and remodeled
TOTAL	48	714	468		The temporary BOQ facilities are located within Camp Forsyth, Camp Funston, Camp Whitside, and Marshall AAF and are mostly vacant Currently occupied buildings are being used as administration buildings and SEBQ facilities All are scheduled for demolition between 1980 and 1985 Temporary guest facilities are scheduled for demolition during this same period
					Categorizing between male and female BOQ facilities is no longer done

FAMILY HOUSING

AREA	TYPE	NUMBER OF BUILDINGS	NUMBER OF FAMILY UNITS	YEAR OF CONSTRUCTION	TYPE OF CONSTRUCTION FUNDS	REMARKS
Custer Hill	CGO/WO	30	126	1957	MCA	Family housing at Fort Riley consists of a variety of single units, duplexes and multi-family units In general, units become occupied as soon as they are vacated
	CGO/WO	70	70	1962	Capehart	
	CGO/WO	22	50	1976-1977	MCA	
	NCO	74	433	1959	Capehart	
	NCO	797	797	1963	Capehart	
	NCO	132	810	1976-1977	MCA	
	NCO/EM	25	100	1976-1977	MCA	
Colyer Apartments	NCO	60	360	1950	Wherry	Units indicated as being built in 1977 were not totally completed as of May 1977, but constitute all currently planned new family housing for the installation
	NCO	45	141	1976	MCA	
Main Post	General	3	3	1887-1904		All units are in good to excellent condition, including those on the main post constructed in the nineteenth century, which have been well maintained Several of the older residences on the Main Post are listed on the National Register of Historic Places
	Colonel	16	16	1889-1934		
	Lt Col Major	52	137	1855-1959		
	CGO/WO	15	41	1888-1910		
	CGO/WO	27	53	1925-1939		
	CGO/WO	4	32	1950	MCA	
	NCO	1	1	1917		
Marshall AAF	Colonel	5	5	1934		
	CGO/WO	6	6	1934		
TOTAL		1,384	3,181			

WATER SUPPLY

TYPE	CAPACITY	COMPUTED DEMAND	REMARKS
Supply			All wells are located in Republican River Valley Existing volume is adequate for current needs, however, water quality is poor None of the wells have an emergency power source
9 wells	8,160,000 GPD	3,632,400 GPD (Average) 7,972,400 GPD (Peak) (see remarks)	
Treatment			Water treatment currently consists of the addition of chlorine and sodium hexametaphosphate to well water Hydrofluosilic acid is added to the main post system No treatment facilities exist to remove undesirable elements or for softening
Storage			Storage facilities consist of ten 500,000 gallon tanks and one 250,000 gallon tank, most of which are elevated Total storage capacity is more than adequate, but tank location hinders optimum water distribution
11 tanks	5,250,000 gallons		Computed average demand is the sum of the average domestic demand and the fire demand The average domestic demand is based on an available daily per capita consumption of 150 gallons multiplied by the 1976 installation population of 19,400 yielding 2,910,000 gallons per day (GPD)
			The fire demand is computed as the sum of the gallons per minute rate of consumption required to fight two 4-hour fires daily plus 50 percent of the average domestic gallons per minute demand rate, yielding 722,400 GPD Computed peak demand is the sum of the peak domestic demand and the average fire demand Peak domestic demand is based on a daily per capita consumption of 325 gallons multiplied by the 1976 installation population of 19,400 yielding 7,250,000 GPD

SEWERAGE

PLANTS	CAPACITY	COMPUTED DAILY FLOW	REMARKS
Main Post	1 3 MGD	0 4 MGD	Provides primary and secondary treatment to Main Post, Marshall AAF, Camp Whitside and Camp Funston
Camp Forsyth	0 9 MGD	0 2 MGD	Provides primary and secondary treatment to Camp Forsyth and Colyer Apartments
Custer Hill	1 9 MGD	1 3 MGD	Provides primary and secondary treatment to Custer Hill Family Housing and Troop Housing areas
TOTAL	4 1 MGD	1 9 MGD	All sewage collection and disposal systems are in very good condition and have adequate hydraulic capacities for current and future needs
			Computed daily flow is based on a per capita production rate of 100 gallons per day (GPD) times the 1976 population of each particular area The 1976 population of the area served by Main Post plant was 4,100, while the areas served by the Camp Forsyth and Custer Hill plants had a 1976 population of 2,100 and 13,200 respectively

SCHOOLS AND MEDICAL FACILITIES

TYPE	CAPACITY	CURRENT LOAD	REMARKS
Schools			
Elementary	2,070 in 4 schools Ft Riley Morris Hill Jefferson Custer Hill	3,309	All schools are administered by the Junction City, Kansas Board of Education The recent completion of family housing in the Custer Hill area has caused a serious deficiency in school capacities It has been recommended that existing facilities be expanded and that a new elementary school and a new junior high school be constructed Senior high students attend class in Junction City
Junior High	500	831	
Senior High	None		
Medical Facilities			
Irwin Army Hospital	250 beds		Readily expandable to 500 beds within existing facility
Mobilization Hospital Complex	650 beds		Temporary structures built as support facilities during World War II Presently being used as temporary support space for Irwin Army Hospital, these buildings are scheduled for demolition by 1985
			A helicopter landing area is located directly north of the Irwin Army Hospital across Third Street
Dental Clinics	31 chairs in 3 clinics		Additional dental care provided at Irwin Army Hospital A fourth clinic is being constructed in the Custer Hill Troop Housing Area
Dispenseries	7 facilities		
Clinics	23		Clinical services provided as part of outpatient section at Irwin Army Hospital

RECREATION FACILITIES

FACILITY	CAPACITY AND LIGHTING	REMARKS
Moon Lake		All four parks are equipped with playground and picnicking facilities and are extensively utilized In addition, Moon Lake contains facilities for Boy and Girl Scout activities
Wyman Park		
Mullens Park		
Anzio Park		
2 Golf Courses		
4 Softball fields	lighted	There are several basketball, tennis and multi-purpose courts, playgrounds, and recreation centers located in close proximity to troop and family housing areas Other major facilities include 6 gymnasiums, and 2 museums Most of the Main Post area has been designated as a Historic District with 21 buildings listed on the National Register The Kansas Territorial Capitol Building is located near Camp Whitside and is currently used as a museum There were no plans for expansion of recreational facilities on post at the time of this study
2 Softball Fields	unlighted	
1 Baseball/Football Field	lighted	
4 Baseball Fields	unlighted	
1 Football Field	unlighted	
2 Track and Field Facilities		
6 Outdoor Recreation Areas		
4 Outdoor Swimming Pools		
2 Indoor Swimming Pools		
1 Rod and Gun Club		
1 Riding Club		

TELECOMMUNICATIONS

TYPE	CAPACITY	REMARKS
Unofficial Telephone		There were 6,200 lines of automatic switching equipment and approximately 9,427 telephones in use on-post at the time this study was conducted
United Telephone 238 Exchange	86 incoming trunks 26 outgoing trunks 7,000 lines	
United Telephone 762 Exchange	49 outgoing trunks 24 telephone operator positions 4 information positions 3,000 lines	United Telephone Company of Kansas, Inc , provides long-distance service to the Fort Riley exchanges United Telephone is presently installing direct dial commercial service to unofficial (Class B) telephone subscribers in the Custer Hill family housing areas Eventual plans call for commercial type service to be installed in existing housing areas (unofficial, Class B type)
Official Telephone		
Main Post Exchange	201 incoming trunks 138 outgoing trunks 22 two-way trunks 4 telephone operator positions 2 information positions 2,400 lines	Connections with other military installations are provided by the AUTOVON long-distance network
		The majority of service lines in permanent areas are underground and overhead in mobilization-type areas Building 483, located in the Camp Whitside area, serves as the Government telephone system maintenance facility
Custer Hill Exchange	104 incoming trunks 141 outgoing trunks 2,800 lines	A recently conducted utility study indicates that present facilities are adequate and in good condition With normal maintenance and repair, the system should be suitable for continued permanent use
Camp Forsyth Exchange	45 incoming trunks 71 outgoing trunks 1,000 lines	
Closed Circuit Educational Television Service		
Military Amateur Radio Service (MARS)		

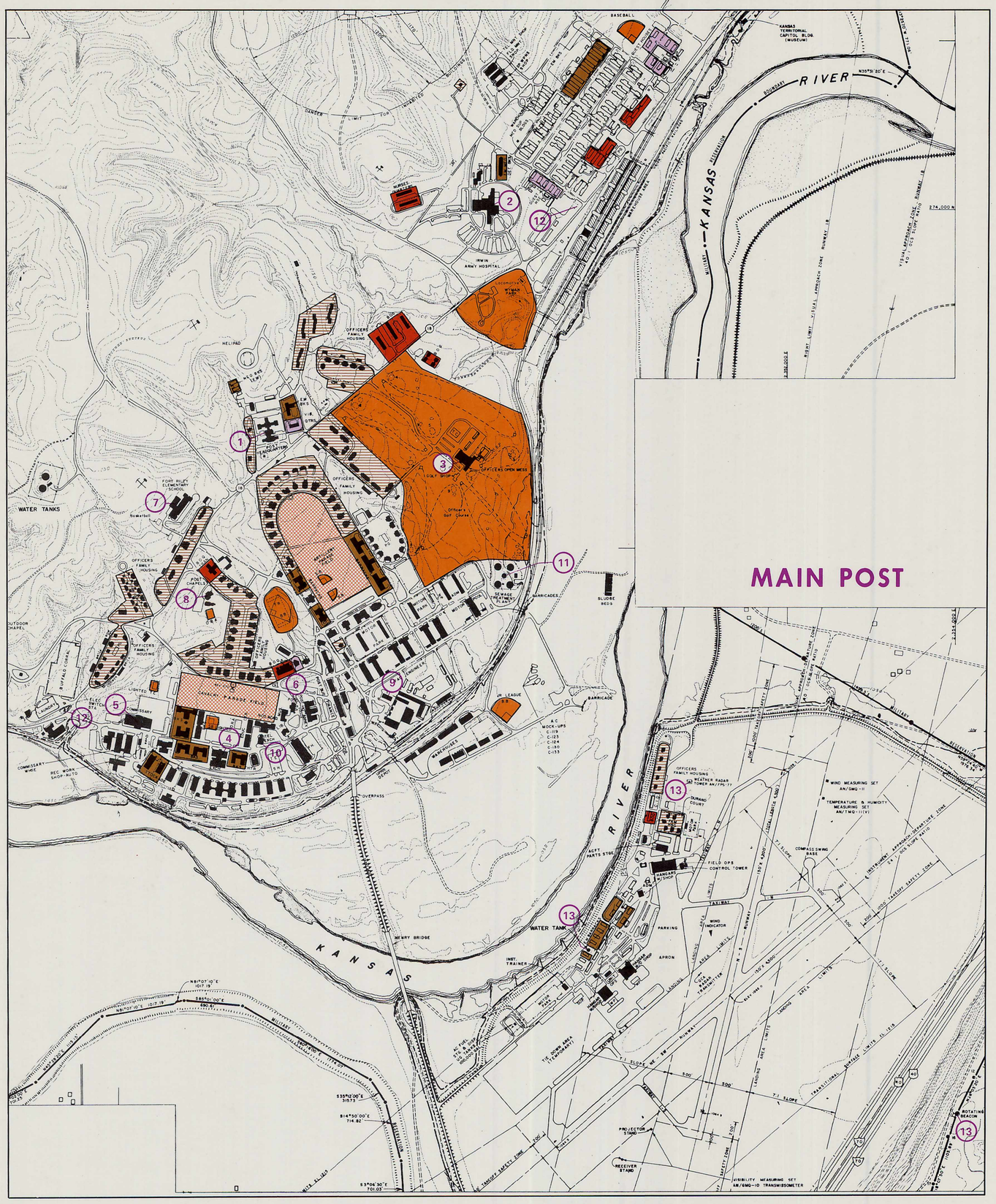
ELECTRICITY

SUBSTATION	CAPACITY (kva)	CURRENT LOAD	REMARKS
Custer Hill # 1	7,500/10,500		Substations at Custer Hill are government owned The remaining substations are owned by Kansas Power and Light (KP&L), which supplies all electricity to the installation Two kva ratings are shown for substations with forced air cooling systems which, when utilized, boost overall capacities to the higher ratings indicated
Custer Hill # 2	7,500/10,500		
Custer Hill # 3	7,500/10,500		
Main Post	7,500/10,500		
Colyer Apartments	5,000/7,000		There has been a continual increase in demand for electricity during recent years attributed in part to a reliance on electricity for heating in new housing units Peak consumption month for the period July 1976–June 1977 was February, 1977 (11,280,200 kw hours) and the lowest consumption month was October 1976 (5,668,800 kw hours) Yearly capacity computes to 324,000,000/418,000,000 kw hours
Whitside	2,500/3,125		
Camp Funston	2,000		Overall, the electrical system is in good condition and should adequately serve to meet demand levels projected for 1980
TOTAL	37,000/47,825	103,546,000 kw hours (FY 1976 total)	

NATURAL GAS

CAPACITY	CURRENT LOAD	REMARKS
Kansas Power and Light Company provides natural gas on a demand basis from southwest Kansas gasfields to Fort Riley	1,320,388 mcf of natural gas were consumed during FY 1976	Pressure is reduced to 35 psi at four supply points at the Main Post, three points at Camp Whitside, two at Camp Funston, and two at Camp Forsyth
Gas is supplied at 300 psi via a 20 3 cm (8 in) main and a 30 5 cm (12 in) main Capacity data were not available in units of cubic feet from either on-post or Kansas Power and Light Company officials		Because the current supply of natural gas is limited nationwide, alternate fuels are being considered for future post expansion Present Army directives do not allow gas service to new facilities and conservation measures, including reduced distribution pressure, have been initiated

URBAN AREAS (CANTONMENT AREAS)



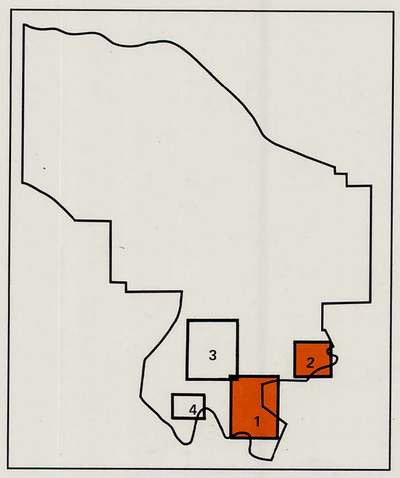
AREA FEATURES

- Family Housing, Officer
- Barracks
- Bachelor Officer Quarters
- Guest Housing, Temporary Quarters
- Parade Grounds
- Outdoor Recreation Area

SITE FEATURES

1. Post Headquarters
2. Post Hospital
3. Officers' Open Mess
4. Post Exchange
5. Commissary
6. Post Office
7. Elementary School
8. Chapel
9. Directorate of Facilities Engineering
10. Telephone Exchange
11. Sewage Treatment Plant
12. Electric Power Substation
13. Flight Obstruction
14. Heating and Cooling Plant

LOCATION DIAGRAM



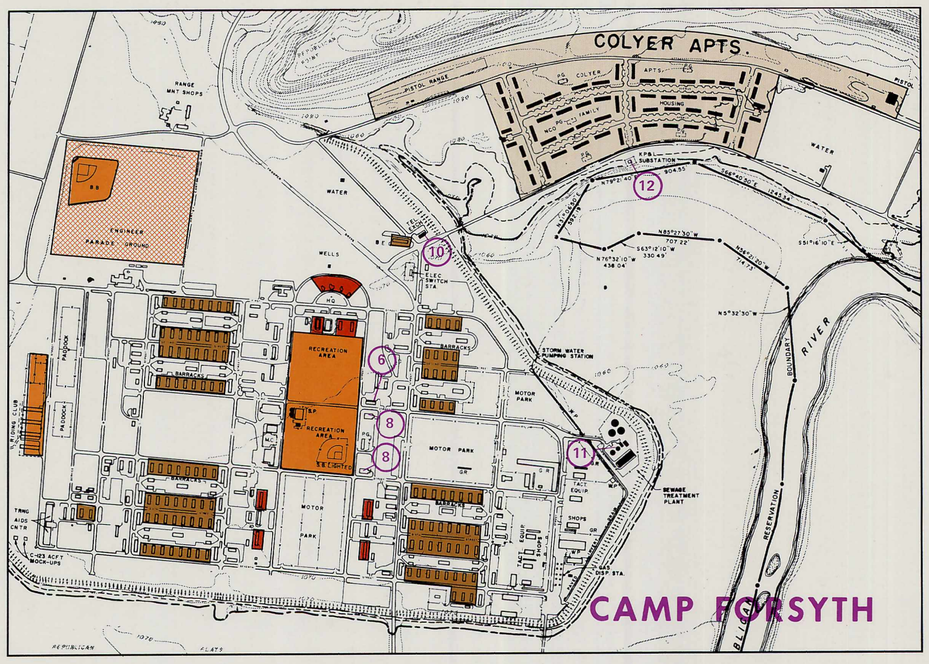
1. Main Post
2. Camp Funston
3. Custer Hill
4. Camp Forsyth

1000 0 1000 2000 3000 Feet

200 100 0 200 400 600 800 Meters

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

URBAN AREAS (CANTONMENT AREAS)



1000 0 1000 2000 3000 Feet

200 100 0 200 400 600 800 Meters

N

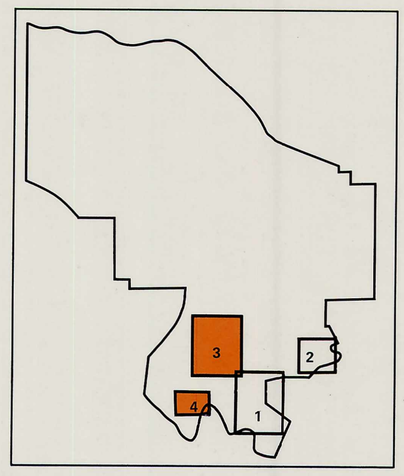
AREA FEATURES

- Family Housing, Officer
- Family Housing, NCO
- Barracks
- Bachelor Officer Quarters
- Parade Grounds
- Outdoor Recreation Area

SITE FEATURES

- (4) Post Exchange
- (6) Post Office
- (7) Elementary School
- (8) Chapel
- (10) Telephone Exchange
- (11) Sewage Treatment Plant
- (12) Electric Power Substation
- (13) Flight Obstruction
- (14) Heating and Cooling Plant
- (15) Middle School

LOCATION DIAGRAM



1. Main Post
2. Camp Funston
3. Custer Hill
4. Camp Forsyth

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L. NON-URBAN CULTURE FEATURES

MAP NUMBER	GRID REFERENCE	DESCRIPTION
1	761518	Windpump ruins
2	767520	Ruins
3	768519	Ruins
4	769525	Ruins
5	775525	Ruins
6	776511	Ruins
7	776506	Ruins
8	764509	Ruins
9	762496	Ruins
10	765491	Ruins
11	776497	Ruins
12	776471	Ruins
13	761456	Ruins
14	765456	Windpump ruins
15	775453	Ruins
16	767443	Ruins
17	772437	Ruins
18	760438	Windpump ruins
19	776437	Ruins
20	781463	Ruins
21	790518	Ruins
22	790511	Range HQ and Tank maintenance area; 4 temporary buildings: mess, 372 m^2 (4,000 ft^2); applied instruction, 113 m^2 (1216 ft^2); latrine, 22 m^2 (240 ft^2); pump station, 6 m^2 (64 ft^2)
23	786510	Ruins
24	792499	Ruins
25	792488	Ruins
26	796477	Ruins
27	788475	Ruins
28	788461	Windpump ruins
29	795461	Ruins
30	800480	Ruins
31	797505	4 temporary buildings: range house, 58 m^2 (621 ft^2); latrine, 22m^2 (240 ft^2); applied instruction, 113 m^2 (1216 ft^2); unidentified building
32	799502	Observation tower; height 4.6 m (15 ft)
33	801518	Ruins
34	807517	Ruins
35	816510	Ruins
36	816506	Ruins
37	816497	Ruins
38	823514	Ruins
39	813491	Ruins
40	828509	Ruins
41	825509	Tank Gunnery Range; 5 temporary buildings: 2 range houses, 58 m^2 (621 ft^2) each; latrine, 22 m^2 (240 ft^2); observation tower, height 4.6 m (15 ft); vehicle storage, 41 m^2 (437 ft^2)
42	789511	Tank Gunnery Range Storage area
43	814509	Tank Gunnery Range
44	814509	Observation tower; temporary structure, height 4.6 m (15 ft)
45	806505	Tank Gunnery Range
46	798501	Tank Gunnery Range
47	793496	Tank Gunnery Range; 4 temporary buildings: range house, 57 m^2 (610 ft^2); applied instruction, 113 m^2 (1216 ft^2); latrine, 22 m^2 (240 ft^2); observation tower, height 4.6 m (15 ft)
48	From: 799491 To: 800491	Moving target
49	From: 800487 To: 801489	Moving target
50	From: 802485 To: 804487	Moving target
51	From: 804483 To: 806485	Moving target
52	808500	Building: vehicle storage, 11 m^2 (120 ft^2)
53	806502	Building: vehicle storage, 11 m^2 (120 ft^2)
54	808492	Building: vehicle storage, 11 m^2 (120 ft^2)
55	805488	Building: vehicle storage, 11 m^2 (120 ft^2)
56	801492	Building: vehicle storage, 11 m^2 (120 ft^2)
57	798499	Target control bunker, 4 m^2 (39 ft^2)
58	802497	Target control bunker, 4 m^2 (39 ft^2)
59	803496	Target control bunker, 4 m^2 (39 ft^2)
60	803490	Target control bunker, 4 m^2 (39 ft^2)
61	802484	Building: vehicle storage, 11 m^2 (120 ft^2)
62	799484	Target control bunker, 4 m^2 (39 ft^2)
63	801486	Target control bunker, 4 m^2 (39 ft^2)
64	794487	Tank Gunnery Range; 5 temporary buildings: range house, 58 m^2 (628 ft^2); applied instruction, 112 m^2 (1207 ft^2); latrine, 22 m^2 (240 ft^2) observation tower, height 4.6 m (15 ft); ammunition platform
65	777429	Ruins
66	799450	Ruins
67	803451	Windpump ruins
68	From: 791510 To: 815510	Buried range cable (telephone)
69	From: 791510 To: 792477	Buried range cable (telephone)
70	From: 785477 To: 792477	Buried range cable (telephone)
71	From: 785477 To: 794414	Buried range cable (telephone)
72	From: 768423 To: 785429	Buried range cable (telephone)
73	From: 809408 To: 814399	Buried range cable (telephone)
74	From: 814399 To: 872400	Buried range cable (telephone)
75	From: 872400 To: 877336	Buried range cable (telephone)
76	837509	Ruins
77	854511	Ruins
78	855507	Ruins
79	854502	Ruins
80	854495	Ruins
81	822484	Ruins
82	838487	Ruins
83	841488	Ruins
84	851487	Ruins
85	855489	Ruins
86	871502	Ruins
87	871495	Ruins
88	874507	Ruins
89	879496	Ruins
90	872485	Ruins
91	821478	Ruins
92	827474	Ruins
93	839472	Ruins
94	843476	Windpump ruins
95	855477	Ruins
96	871481	Ruins
97	871476	Ruins
98	811462	Ruins
99	824462	Windpump ruins
100	833462	Ruins
101	843462	Ruins
102	852462	Ruins
103	857462	Ruins
104	855467	Ruins
105	868461	Windpump ruins
106	871466	Ruins
107	823458	Ruins
108	824455	Windpump ruins
109	840451	Ruins
110	800441	Ruins
111	815445	Ruins
112	835443	Windpump ruins
113	842446	Windpump ruins
114	847449	Ruins
115	851443	Ruins
116	865446	Ruins
117	871442	Ruins
118	796431	Ruins
119	805439	Ruins
120	801432	Ruins
121	809434	Ruins
122	817438	Ruins
123	843434	Ruins
124	859434	Ruins
125	866431	Ruins
126	872428	Ruins
127	779409	Monument; Indian grave
128	821428	Windpump ruins
129	826426	Windpump ruins
130	825415	Windpump ruins
131	819405	Windpump ruins
132	837420	Windpump ruins
133	845426	Windpump ruins
134	852430	Ruins
135	862429	Ruins
136	850416	Windpump ruins
137	865408	Ruins
138	872415	Ruins
139	858402	Ruins
140	873401	Ruins
141	829398	Ruins
142	860389	Ruins
143	858398	Windpump ruins
144	866398	Ruins
145	831366	Ruins
146	845377	Windpump ruins
147	855382	Ruins
148	872390	Ruins
149	871381	Windpump ruins
150	871372	Windpump ruins
151	865367	Ruins
152	859365	Ruins
153	852367	Ruins
154	846368	Ruins
155	839360	Ruins
156	841357	Ruins
157	837356	Ruins
158	831360	Ruins
159	844344	Ruins
160	849344	Ruins
161	851343	Ruins
162	859343	Ruins
163	867344	Ruins
164	874348	Ruins
165	874344	2 buildings: range central, 409 m^2 (4401 ft^2); garage, 50 m^2 (540 ft^2)
166	806405	Amphibious Training HQ: 4 buildings
167	783409	Building: latrine, 23 m^2 (246 ft^2)
168	782408	Building: training course structure
169	811415	Building: latrine, 23 m^2 (246 ft^2)
170	793405	Building: latrine, 23 m^2 (246 ft^2)
171	891485	Building: abandoned farmhouse
172	891484	Silo
173	884487	2 buildings: abandoned farm house and outbuilding
174	893495	Ruins
175	887498	Silo
176	886475	Ruins
177	917472	Ruins
178	914468	Ruins
179	877464	Ruins
180	882462	Ruins
181	889464	Ruins
182	896457	Ruins
183	903457	Ruins
184	909456	Ruins
185	905451	Ruins
186	919452	Ruins
187	929452	Ruins
188	922439	Ruins
189	904444	Ruins
190	907447	Windpump ruins
191	904439	Ruins
192	904435	Ruins
193	888439	Ruins
194	895439	Ruins
195	888438	Windpump ruins
196	874439	Ruins
197	919432	Ruins
198	938438	Ruins
199	970434	Ruins
200	From: 874359 To: 901371	Buried range cable (telephone)
201	From: 907359 To: 973422	Buried range cable (telephone)
202	From: 874344 To: 976395	Buried range cable (telephone)
203	From: 874344 To: 884316	Buried range cable (telephone)
204	913359	Rifle Range
205	912358	3 temporary buildings: range house, 43 m^2 (463 ft^2); latrine, 21 m^2 (227 ft^2); observation tower, height 4.6 m (15 ft)
206	909357	Rifle Range (target detection)
207	914353	Observation Post
208	902372	3 temporary buildings: range house, 43 m^2 (463 ft^2); latrine, 21 m^2 (227 ft^2); observation tower, height 4.6 m (15 ft)

L. NON-URBAN CULTURE FEATURES (Continued)

MAP NUMBER	GRID REFERENCE	DESCRIPTION
209	903372	Rifle Range
210	897372	Rifle Range (target detection)
211	904377	Observation Post
212	911375	Observation Post
213	890386	Observation Post
214	898394	Rifle Range
215	896396	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
216	896400	Pistol Range
217	896400	3 temporary buildings, range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
218	896402	2 temporary buildings range maintenance shop, 387 m^2 (4,161 ft^2), range house, 7 m^2 (80 ft^2)
219	891405	Rifle Range (target detection)
220	891401	Rifle Range (target detection)
221	891397	Rifle Range (target detection)
222	898406	Rifle Range
223	897407	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
224	893409	Rifle Range (target detection)
225	896412	Rifle Range (target detection)
226	898415	Rifle Range (target detection)
227	902418	Rifle Range (target detection)
228	907423	Rifle Range (target detection)
229	917423	Rifle Range (target detection)
230	920425	Rifle Range (target detection)
231	902412	Rifle Range (field firing)
232	902412	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
233	907415	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
234	911419	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
235	912418	Rifle Range (field firing)
236	907415	Rifle Range (field firing)
237	922420	Rifle Range (field firing)
238	924423	Rifle Range
239	922420	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
240	924424	3 temporary buildings range house, 43 m^2 (463 ft^2), latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
241	930427	Rifle Range (techniques of fire)
242	930430	2 buildings range mess, 241 m^2 (2,591 ft^2), latrine 31 m^2 (331 ft^2)
243	930429	Water tower height 18 m (60 ft), storage capacity 83,270 liters (22,000 gallons)
244	931428	4 temporary buildings range house, 58 m^2 (625 ft^2), equipment shed, 47 m^2 (512 ft^2), latrine, 31 m^2 (331 ft^2), observation tower, height 4 6 m (15 ft)
245	946427	Rifle Range (battle drill and assault)
246	946430	2 temporary buildings range mess, 241 m^2 (2,591 ft^2), latrine, 31 m^2 (331 ft^2)
247	947429	4 temporary buildings range house, 58 m^2 (625 ft^2), equipment shed, 48 m^2 (512 ft^2), latrine, 31 m^2 (331 ft^2), observation tower, height 4 6 m (15 ft)
248	959429	2 temporary buildings range mess, 241 m^2 (2,591 ft^2), latrine, 31 m^2 (331 ft^2)
249	961424	4 temporary buildings range house, 58 m^2 (625 ft^2), equipment shed, 48 m^2 (512 ft^2), latrine, 31 m^2 (331 ft^2), observation tower, height 4 6 m (15 ft)
250	960422	Rifle Range (squad attack)
251	969411	Rifle Range (squad defense)
252	973422	Building range maintenance
253	971418	2 temporary buildings range mess, 241 m^2 (2,591 ft^2), latrine, 31 m^2 (331 ft^2)
254	969413	4 temporary buildings range house, 58 m^2 (625 ft^2), equipment shed, 48 m^2 (512 ft^2), latrine, 31 m^2 (331 ft^2), observation tower, height 4 6 m (15 ft)
255	970412	Water tower height 18 m (60 ft), storage capacity 60,560 liters (16,000 gallons)
256	973402	Rifle Range
257	969397	Rifle Range (field firing, demonstrations)
258	974396	Observation tower, height 9 m (30 ft)
259	969385	Mock Village Combat in Towns training range
260	971385	Building latrine, 20 m^2 (216 ft^2)
261	949407	Observation Post
262	963402	Observation Post
263	961396	Observation Post
264	964395	Observation Post
265	965390	Observation Post
266	967383	Observation Post
267	966375	Observation Post
268	970367	Observation Post
269	964354	Observation Post
270	964350	Machine Gun Range
271	965349	2 temporary buildings range house, 58 m^2 (625 ft^2), latrine, 23 m^2 (250 ft^2)
272	969355	Hand Grenade Range
273	969358	Close Combat Course
274	969357	Ruins
275	968339	2 Observation Towers heights 4 6 m (15 ft)
276	954338	Rifle Range
277	949340	Rifle Range
278	943341	Rifle Range
279	937339	Claymore Mine Demolition Training Range
280	931337	Rifle Range
281	944339	Building range house, 40 m^2 (432 ft^2)
282	946339	2 buildings latrine, 21 m^2 (227 ft^2), observation tower, height 4 6 m (15 ft)
283	949340	2 observation towers heights 4 6 m (15 ft)
284	929344	Observation Post
285	927345	Observation Post
286	926347	Observation Post
287	921349	Observation Post
288	974363	Ruins
289	956326	Bleachers, permanent
290	998338	2 radio towers
291	988344	Ruins
292	933336	Building latrine, 23 m^2 (224 ft^2)
293	947326	Observation Post
294	935327	Observation Post
295	924325	Observation Post
296	956306	Rifle Range
297	950304	Skeet Range
298	946305	Rifle Range
299	945297	Pistol Range
300	946295	Rifle Range
301	940290	Rifle Range
302	920287	Ammunition Storage Area
303	923287	Fence perimeter of ammunition storage area
304	871495	Silo
305	858292	Repelling tower height 12 m (40 ft)
306	862289	Slide for life tower height 23 m (75 ft)
307	861286	Observation tower height 6 m (20 ft)
308	884277	Observation tower height 4 6 m (15 ft)
309	886276	2 water tanks, heights 9 m (30 ft), capacity 1,892,500 liters (500,000 gallons) each
310	907260	Cemetery
311	900272	Camp Moon Recreation Area
312	897273	Building 12 m^2 (133 ft^2)
313	899270	2 buildings 3 m^2 (37 ft^2) each
314	901269	3 buildings Boy Scout building, 86 m^2 (927 ft^2) Boy Scout building, 76 m^2 (823 ft^2), shelter house
315	899265	Building chlorinator 18 m^2 (190 ft^2), capacity 7,000,000 gallons per day
316	901263	Anzio Park
317	902262	Building 15 m^2 (163 ft^2)
318	911268	2 water tanks capacity 1,892,500 liters (500,000 gallons) each
319	911267	Building pump house, 94 m^2 (1,016 ft^2)
320	936290	2 water tanks capacity 1,892,500 liters (500,000 gallons) each
321	914295	Cable TV tower height 61 m (200 ft)
322	879320	MARS antennae field approximately 17 structures, height of highest antennae 21 m (70 ft)
323	886391	Observation Post
324	From 904316 To 971411	7 2/12 4 KV powerlines shown only outside of cantonment area
325	937401	Ruins
326	955412	Ruins
327	898380	Windpump ruins
328	762420	2 temporary buildings boat maintenance shop, 80m^2 (864 ft^2), fuel storage tank, capacity 7,570 liters (2,000 gallons)
329	761418	Building PX concession, 33m^2 (360 ft^2)
330	768423	4 temporary buildings range house, 21m^2 (223 ft^2), mess, 113 m^2 (1,216 ft^2), 2 outbuildings
331	770418	Building latrine, 23m^2 (246 ft^2)
332	771414	3 temporary buildings 2 change houses, 33m^2 (360 ft^2) each, latrine, 15m^2 (163 ft^2)
333	928273	Wyman Park
334	893268	Pistol Range
335	958280	Sanitary Landfill
336	865269	Rifle Range
337	861268	Building range house, 183m^2 (1,968 ft^2)
338	From 865273 To 868273	Revetment length 244m (800 ft)
339	From 869273 To 871271	Revetment length 244m (800 ft)
340	From 866268 To 867272	Revetment length 457m (1,500 ft)
341	From 862273 To 870271	Revetment length 1,006 m (3,300 ft)
342	921295	Corral
343	921295	Fence perimeter of corral
344	911261	Buffalo corral
345	842486	Ruins
346	820515	Ruins
347	859486	Ruins
348	870499	Ruins
349	868499	Ruins
350	872493	Ruins
351	872419	Ruins
352	847374	Windpump ruins
353	850366	Ruins
354	847366	Ruins
355	921454	Ruins
356	906445	Ruins
357	905432	Ruins
358	891440	Ruins
359	910353	Rifle Range (target detection)
360	951337	Rifle Range

Note Several of the features on the Non-Urban Culture Features map are located outside of the military reservation boundary These features are located adjacent to Milford Lake in an area in which Fort Riley holds rights for recreational as well as minor training uses

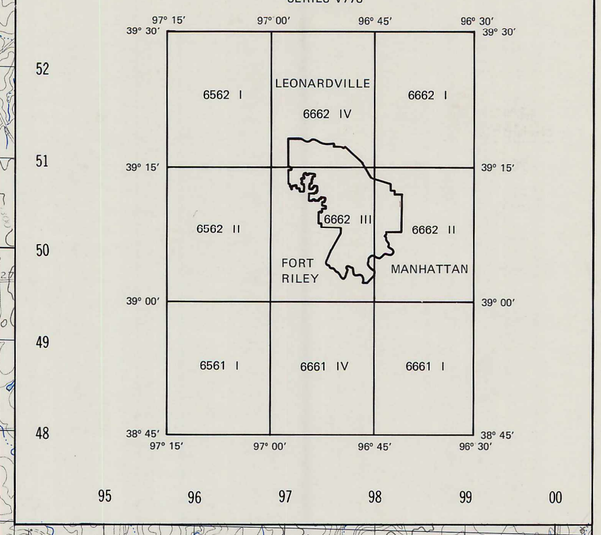
FORT RILEY, KANSAS
TERRAIN ANALYSIS

NON-URBAN CULTURE FEATURES

- Tower (Lookout, Fire, Guard, Observation)
- TV/Radio Tower
- Water Tower
- Windpump Ruins
- Building
- Silo
- Water Tank
- Monument
- Power Line
- Buried Cable
- Fence
- Cemetery
- Corral
- RA — Recreation Area
- SL — Sanitary Landfill
- Ruins
- Bleachers, permanent
- Observation Post/Bunker
- Training Tower
- Mock Village
- Ammunition Storage
- Revetment
- MT — Moving Target
- S — Skeet Range
- P — Pistol Range
- RR — Rifle Range
- MG — Machine Gun Range
- TG — Tank Gunnery Range
- HG — Hand Grenade Range
- Mine — Claymore Mine Demolition Range
- CC — Close Combat Course

Map numbers refer to entries in table.

1:50,000 SHEET INDEX
SERIES V778



Scale 1:50,000

1 0 1 2 3 Statute Miles

1000 0 1000 2000 3000 4000 5000 Meters

CONTOUR INTERVAL 20 FEET

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

III. OFF-POST FEATURES

Off-Post Features covered by this study and described in the accompanying tables consist of airfields and urban areas within a 50-mile radius of Fort Riley Locations are shown on the map which is presented following the tables

AIRFIELDS. The Salina Municipal Airport is the only airfield within a 50-mile radius of the installation with a capability of handling cargo-troop transport aircraft equivalent to the C-130 Hercules or larger The Salina facility is a civil airfield located 80 kilometers (50 miles) southwest of Fort Riley accessable via Interstate Highways 70 and 35W Data on the Manhattan Municipal Airport are also reported in the tables even though it does not have the capability of handling large cargo-troop transport aircraft The Manhattan facility is not shown on the map because it does not have this required capability, but is described tabularly due to its importance as the closest major airfield providing regularly scheduled commercial airline service to the Fort Riley area

URBAN AREAS. There are 8 urban areas with a population of 2,500 or more within a 50-mile radius of Fort Riley All are incorporated and located within Kansas Populations range from 2,600 to 39,682

Of major importance to Fort Riley are the towns of Junction City and Manhattan Junction City has a current estimated population of 20,513 and is 6 4 kilometers (4 miles) southwest of the Main Post, while Manhattan, 19 3 kilometers (12 miles) to the northeast has a population of 30,186 These two cities serve as the major contributors to off-post housing, education, and recreation facilities and services for Fort Riley As an example, seventy-five percent of military personnel and their dependents assigned to Fort Riley living off-post reside in either of these two urban areas, with the majority in Junction City As an example of Fort Riley's importance to Junction City and Manhattan, employment statistics indicate that the majority of the jobs are in service industries, especially government The latter also reflects the influence of Kansas State University in Manhattan, which has a 1976-1977 enrollment of 17,467

The largest urban area included in this study is Salina, 80 kilometers (50 miles) southwest of Fort Riley Salina serves as a major service center and is the location of the Salina Municipal Airport The closest major urban area is Topeka, 97 kilometers (60 miles) to the east, which serves as the state capitol and is also important as a major trade and transportation center Topeka has a current estimated population in excess of 125,000

The overall function of the region within the study area is agricultural in nature with crop farming predominating Cities depend heavily on the rural population and many agriculturally-related industries for their economic stability and growth Agricultural activity should continue to be of major importance in the future as the past trends of increased farm size and specialization continue in the future However, the overall employment mix can be expected to become more service and trade oriented

Population growth throughout the region has been moderate in the last decade and has generally been focused within and adjacent to the urban areas described in this study Future growth throughout the area including areas adjacent to Fort Riley, will most probably continue according to these past trends Total population of the Fort Riley-Junction City-Manhattan area can be expected to fluctuate as the number of personnel assigned to Fort Riley and the student enrollment at Kansas State University change

In addition to the recreation facilities listed in the tables, there are several large outdoor recreation areas in the vicinity of Fort Riley which cannot be properly assigned to one particular settlement These include Milford Lake and Tuttle Creek Lake which provide facilities for boating, swimming, water skiing, fishing, camping, and related outdoor recreation activities State parks within the immediate vicinity of Fort Riley include Geary County State Lake and Park, south of Junction City, Kansas State Park and Clay County State Lake and Park on Milford Reservoir, Pottawatomie County State Lake and Park Number 2, north of Manhattan, and Council Grove Reservoir, northwest of Council Grove

Data presented on housing and educational facilities are generally applicable to the county within which a particular area lies

A. AIRFIELDS

MAP NUMBER AND/OR NAME, LOCATION, TYPE, AND CLASSIFICATION	ELEVATION AND STATUS	RUNWAY DESCRIPTION [1]	TAXIWAY, PARKING APRON, AND HARDSTAND AREA DESCRIPTION	BUILDING DESCRIPTION	POL FACILITIES [2]	NAVIGATIONAL AIDS	REMARKS
Name Salina Municipal **Location** 38°48'N, 97°39'W **Type** Airfield **Classification** Civil	**Elevation** runway 388 m (1,272 ft), top of control tower 414 m (1,357 ft) **Status** Operational	**Longest Runway** 4,063 m (13,330 ft) long, 91 m (300 ft) wide, azimuth 170°-350°, weight bearing capacity—S75, T200 ST175, TT350, concrete surface in good condition **Other Runway** 2,742 m (8,997 ft) long, 46 m (150 ft) wide, azimuth 120°-300°, weight bearing capacity—TT125, asphalt/concrete surface in good condition	**Taxiways**· Number, no data, widths vary from 21 m (70 ft) to 46 m (150 ft), weight bearing capacity—TT350, surface material—concrete and asphalt over concrete **Parking Aprons and Hardstand Areas** Total area, no data, weight bearing capacity, no data, concrete surface in good condition	**Hangars**· 10 large, 34 T-type hangars, all leased **Maintenance buildings** No data **Administration-terminal** No data	**Types of fuel** US aviation fuels (MIL SPECS) 100/130, commercial aviation fuels 80/87, 100/130, jet fuel ASTM Type A, US aviation oil (MIL SPECS) 1100 (dispersant), reciprocating engine oil (MIL-L-22851 Type 11), contract fuel provided by Flower Aviation of Kansas	**Communications and Navigation** Control tower, flight service station Salina, VFR advisory service by FSS when tower closed, VORTAC, instrument landing system (ILS) **Lighting**· Rotating beacon, runway lights, approach lights, high intensity runway lights, sequenced flashing lights, runway end identifier lights (REIL) (threshold strobe lights)	Aerodrome is only partially covered by the USAF NOTAM System but does not maintain a military NOTAM file
Name Manhattan Municipal **Location** 39°09'N, 96°40'W **Type** Airfield **Classification** Civil	**Elevation** Runway 322 m (1,056 ft) **Status** Operational	**Longest Runway** 1,676 m (5,500 ft) long, 30 5 m (100 ft) wide, azimuth 030°-210°, weight bearing capacity—S24, T33, TT55, concrete surface in fair condition (cracks, spalling) **Other Runway**· 1,158 m (3,800 ft) long, 30 5 m (100 ft) wide, azimuth 132°-312°, weight bearing capacity—same as longest runway, concrete surface in fair condition	**Taxiways**· 1, 15 m (50 ft) wide, weight bearing capacity—TT55, concrete surface **Parking Aprons and Hardstand Areas:** Total area approximately 7,440 m² (80,000 ft²), weight bearing capacity—TT55, concrete surface	**Hangars** 1 Dimensions 30 5 m x 24 x 6 m (100 ft x 80 ft x 20 ft), construction material—stone, plus 4 T-hangars, construction material—metal **Maintenance buildings** 1 (stone hangar described above) **Administration-terminal buildings** 1 Floor space 446 m² (4,800 ft²)	**Types of fuel** Commercial aviation fuels 80/87, 100/130, 115/145, jet fuel ASTM Type A **Storage and dispensing facilities** 4 pumps, 2 trucks, 4—2,500 gallon underground storage tanks.	**Communications and Navigation:** Flight Service Station Manhattan (DT 1100-0300Z) other times Flight Service Station Salina, VOR unusable, no control tower **Lighting.** Rotating beacon, runway lights, visual approach slope indicator systems, runway end identifier lights (REIL) (threshold strobe lights)	Aerodrome is only partially covered by USAF NOTAM system but does not maintain a military NOTAM file Restricted area WNW (Ft Riley Small Arms Range impact area) Use right traffic pattern Rwy 13-31 Attended 1200-0600Z (DT 1100-0500Z) **Note** Because of past damage to runways and insufficient ramp space, Manhattan City ordinance prohibits the landing of aircraft that have a gross landing weight of 55,000 lbs or more, except in an emergency

[1] Runway weight bearing capacity in pounds (gross weight of aircraft) is determined by adding 000 to figure following S, T, ST, TT, TDT Runway weight bearing capacity given is for unlimited operations Aircraft weight higher than given requires prior permission from aerodrome controlling authority

S — Runway weight bearing capacity for aircraft with single-wheel type landing gear (C-47, F-100)

T — Runway weight bearing capacity for aircraft with twin-wheel type landing gear (C-94)

ST— Runway weight bearing capacity for aircraft with single-tandem landing gear (C-130)

TT— Runway weight bearing capacity for aircraft with twin-tandem type (includes quadricycle) landing gear (B-52, C-135)

For further information, see DOD Flight Information Publication (Enroute IFR-Supplement United States)

[2] ASTM—Commercial jet fuels conform to specifications established by the American Society for Testing Materials

B. URBAN AREAS

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES [1]	REMARKS
Abilene, Kansas (Dickinson County) 38°54'N 97°12'W	1970 Census 6,661 Estimated 1977 8,041 Projected 1980 9,200	**Houses:** Number of houses 2,500 Number of houses rented 100-150 Average monthly rent $100-$175 Percent rental vacancies 0% New home starts, 1976 20 Average number of sales per year 300 Average sale price $25,000 **Apartments**· Number of apartments 250 Average monthly rent $100-$275 Average percent vacant 5% (1977 data)	**Elementary Schools** Number of schools 3 Enrollment capacity 560 Current enrollment 685 Projected enrollment, 1980 560 Expansion plans None **Junior High Schools** Number of schools 1 Enrollment capacity 450 Current enrollment 418 Projected enrollment, 1980 370 Expansion plans None **High Schools.** Number of schools 1 Enrollment capacity 625 Current enrollment 588 Projected enrollment, 1980 575 Expansion plans None (1976-1977 Data)	**Doctors** Total number 8 Doctor/population ratio 1/1,005 **Dentists** Total number 6 Dentist/population ratio 1/1,340 **Hospitals.** Total number 1 Total beds 70 Coronary-care units 1 Intensive care units 1 Expansion plans None	**Parks** 3 **Athletic Fields:** 10 **Tennis Courts** 8 **Golf Courses** 2	**Electric Power.** Source Kansas Power and Light Co Distributor Kansas Power and Light Co Type Coal, gas, and oil fired thermoelectric plants Expansion plans 1 coal-fired plant under construction (Jeffrey Energy Center) **Sewage Disposal** Number of treatment plants 1 Total capacity 1 2 MGD Average daily flow 0 8 MGD Type of treatment Secondary Expansion plans Tertiary treatment to be added 1978 **Heating Fuels.** Type available Natural gas Expansion plans None **Water Supply.** Source City of Abilene, wells Adequacy of service Excellent Expansion plans None	
Clay Center, Kansas (Clay County) 39°23'N 97°08'W	1970 Census 4,963 Estimated 1977 5,100 Projected 1980 5,500	**Houses** Number of houses 2,950 Number of houses rented No data Average monthly rent $100 Percent rental vacancies 0% New home starts, 1976 27 Average number of sales per year 127 Average sale price $30,000 **Apartments** Number of apartments 50 Average monthly rent $80 Average percent vacant 0% (1977 data)	**Elementary Schools** Number of schools 2 Enrollment capacity 500 Current enrollment 460 Projected enrollment, 1980 436 Expansion plans None **Junior High Schools** Number of schools 1 Enrollment capacity 300 Current enrollment 280 Projected enrollment, 1980 277 Expansion plans New library, industrial arts, and home economics facilities planned **High Schools** Number of schools 1 Enrollment capacity 600 Current enrollment 550 Projected enrollment, 1980 470 Expansion plans None (1976-1977 data)	**Doctors**· Total number 7 Doctor/population ratio 1/729 **Dentists:** Total number 4 Dentist/population ratio 1/1,275 **Hospitals** Total number 1 Total beds 55 Coronary-care units 1 Intensive care units 1 Expansion plans None	**Parks** 4 **Athletic Fields:** 3 **Tennis Courts** 4 **Golf Courses** 1	**Electric Power** Source Clay Center Electric and Water Co Distributor Clay Center Electric and Water Co Type Steam and internal combustion engine driven generators Expansion plans None **Sewage Disposal**· Number of treatment plants 1 Total capacity Unknown Average daily flow No flow meter Type of treatment Primary Expansion plans Secondary treatment facilities **Heating Fuels**· Type available Natural gas, propane, butane, and fuel oil Expansion plans None **Water Supply** Source Clay Center Electric and Water Co , wells Adequacy of service Good Expansion plans None	

B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
Council Grove, Kansas (Morris County) 38°39'N 97°12'W	1970 Census 2,403 Estimated 1977 2,600 Projected 1980 2,700	**Houses** Number of houses 890 Number of houses rented 95 Average monthly rent $95 Percent rental vacancies 1% New home starts, 1976 8 Average number of sales per year 30 Average sale price $21,500 **Apartments** Number of apartments 145 Average monthly rent $95 Average percent vacant 2% (1977 data)	**Elementary Schools** Number of schools 2 Enrollment capacity 380 Current enrollment 350 Projected enrollment, 1980 360 Expansion plans None **Junior High Schools** Number of schools None **High Schools** Number of schools 1 Enrollment capacity 435 Current enrollment 396 Projected enrollment, 1980 400 Expansion plans None (1976-1977 data)	**Doctors** Total number 5 Doctor/population ratio 1/520 **Dentists** Total number 2 Dentist/population ratio 1/1,300 **Hospitals** Total number 1 Total beds 30 Coronary-care units 1 Intensive care units None Expansion plans Addition of outpatient area	**Parks** 3 **Athletic Fields** 4 **Tennis Courts** 3 **Golf Courses** 1	**Electric Power** Source Kansas Power and Light Co Distributor Kansas Power and Light Co Type Coal, gas, and oil-fired thermoelectric plants Expansion plans 1 coal-fired plant under construction (Jeffrey Energy Center) **Sewage Disposal** Number of treatment plants 1 Total capacity 1 MGD Average daily flow 0 75 MGD Type of treatment Primary, secondary Expansion plans None **Heating Fuels** Type available Natural gas, fuel oil, propane Expansion plans No data **Water Supply** Source City of Council Grove, 202 hectare (500 acre) lake Adequacy of service Very good Expansion plans Water supply augmented by 1,214 hectare (3,000 acre) reservoir, No expansion planned	
Herington, Kansas (Dickinson County) 38°41'N 96°57'W	1970 Census 3,165 Estimated 1977 3,596 Projected 1980 No data	**Houses** Number of houses 1,300 Number of houses rented 250 Average monthly rent $90 Percent rental vacancies 10% New home starts, 1976 6 Average number of sales per year 25 Average sale price $17,000 **Apartments** Number of apartments 65 Average monthly rent $80 Average percent vacant 10% (1977 data)	**Elementary Schools** Number of schools 1 Enrollment capacity 450 Current enrollment 264 Projected enrollment, 1980 226 Expansion plans None **Junior High Schools** Number of schools 1 Enrollment capacity 250 Current enrollment 170 Projected enrollment, 1980 175 Expansion plans None **High Schools** Number of schools 1 Enrollment capacity 350 Current enrollment 248 Projected enrollment, 1980 240 Expansion plans None (1976-1977 data)	**Doctors** Total number 4 Doctor/population ratio 1/899 **Dentists** Total number 2 Dentist/population ratio 1/1,798 **Hospitals** Total number 1 Total beds 41 Coronary-care units 1 Intensive care units None Expansion plans None	**Parks** 4 **Athletic Fields** 1 **Tennis Courts** 2 **Golf Courses** 1	**Electric Power** Source Herington Municipal Water and Light augmented by Kansas Power and Light Co Distributor Herington Municipal Water and Light Type Internal combustion engine driven generators Expansion plans Conversion to Kansas Power and Light Co system **Sewage Disposal** Number of treatment plants 1 Total capacity 0 5 MGD Average daily flow More than 0 5 MGD Type of treatment Secondary Expansion plans Underway **Heating Fuels** Type available Natural gas, propane, fuel oil, and coal Expansion plans None **Water Supply** Source Herington Municipal Water and Light, Lake Herington Adequacy of service Good Expansion plans New source needed, distribution system expansion planned	
Junction City, Kansas (Geary County) 39°01'N 96°49'W	1970 Census 19,018 Estimated 1977 20,513 Projected 1980 No data	**Houses.** Number of houses 5,000 Number of houses rented 1,000 Average monthly rent $250–$275 Percent rental vacancies Less than 5% New home starts, 1976 60 Average number of sales per year No data Average sale price $40,000 **Apartments** Number of apartments 1,100 Average monthly rent $150–$225 Average percent vacant Less than 5% (1977 data)	**Elementary Schools.** Number of schools 11 Enrollment capacity 3,000 Current enrollment 4,000 Projected enrollment, 1980 5,000 Expansion plans Remodeling of 5 schools and construction of two new schools at Fort Riley, construction of new school in Junction City **Junior High Schools** Number of schools 2 Enrollment capacity 1,200 Current enrollment 1,460 Projected enrollment, 1980 1,600 Expansion plans Construction of a new school at Fort Riley **High Schools** Number of schools 1 Enrollment capacity 1,000 Current enrollment 1,130 Projected enrollment, 1980 1,400 Expansion plans Expansion of existing facility under consideration (1976-1977 data)	**Doctors** Total number 8 Doctor/population ratio 1/1,005 **Dentists** Total number 7 Dentist/population ratio 1/1,148 **Hospitals** Total number 1 Total beds 100 Coronary-care units 1 Intensive care units 1 Expansion plans None	**Parks** 4 **Athletic Fields** 2 **Tennis Courts** 3 **Golf Courses** 4	**Electric Power** Source Kansas Power and Light Co Distributor Kansas Power and Light Co Type Coal, gas, and oil-fired thermoelectric plants Expansion plans 1 coal-fired plant under construction (Jeffrey Energy Center) **Sewage Disposal** Number of treatment plants 1 Total capacity 6 MGD Average daily flow 2 MGD Type of treatment Primary Expansion plans Secondary treatment planned **Heating Fuels** Type available Natural gas Expansion plans No data **Water Supply** Source Municipal water system, wells Adequacy of service Excellent Expansion plans New plant under construction	Education data are for Geary County Unified Schools, which include the facilities on Fort Riley [see K Urban Areas (Cantonment Areas)]
Manhattan, Kansas (Riley County) 39°11'N 96°34'W	1970 Census 27,575 Estimated 1977 30,186 Projected 1980 32,158	**Houses** Number of houses 6,157 Number of houses rented 1,560 Average monthly rent $250 Percent rental vacancies 1 6% New home starts, 1976 231 Average number of sales per year 1,000 Average sale price $40,000 **Apartments** Number of apartments 3,419 Average monthly rent $175 Average percent vacant 1 9% **Mobile Homes** Number 1,000 (1977 data)	**Elementary Schools** Number of schools 9 Enrollment capacity 3,725 Current enrollment 3,344 Projected enrollment, 1980 3,641 Expansion plans Undecided **Junior High Schools** Number of schools 1 Enrollment capacity 1,300 Current enrollment 1,264 Projected enrollment, 1980 1,250 Expansion plans Undecided **High Schools** Number of schools 2 Enrollment capacity 1,545 Current enrollment 1,491 Projected enrollment, 1980 1,628 Expansion plans Undecided **Vocational Schools** Number of schools 1 Current enrollment 340 **Colleges and Universities** Number 1, (Kansas State University) Current enrollment 17,467 (1976-1977 data)	**Doctors** Total number 40 Doctor/population ratio 1/755 **Dentists** Total number 14 Dentist/population ratio 1/2,156 **Hospitals** Total number 2 Total beds 191 Coronary-care units 2 Intensive care units 2 Expansion plans Both hospitals plan expansion, details unknown	**Parks** 18 **Athletic Fields** 18 **Tennis Courts** 9 **Golf Courses** 2	**Electric Power** Source Kansas Power and Light Co Distributor Kansas Power and Light Co Type Coal, gas, and oil-fired thermoelectric plants Expansion plans 1 coal-fired plant under construction (Jeffrey Energy Center) **Sewage Disposal** Number of treatment plants 1 Total capacity 12 5 MGD Average daily flow 4 MGD Type of treatment Primary, secondary Expansion plans None **Heating Fuels** Type available Natural gas, propane, fuel oil Expansion plans None **Water Supply** Source City of Manhattan, wells Adequacy of service Excellent Expansion plans None	

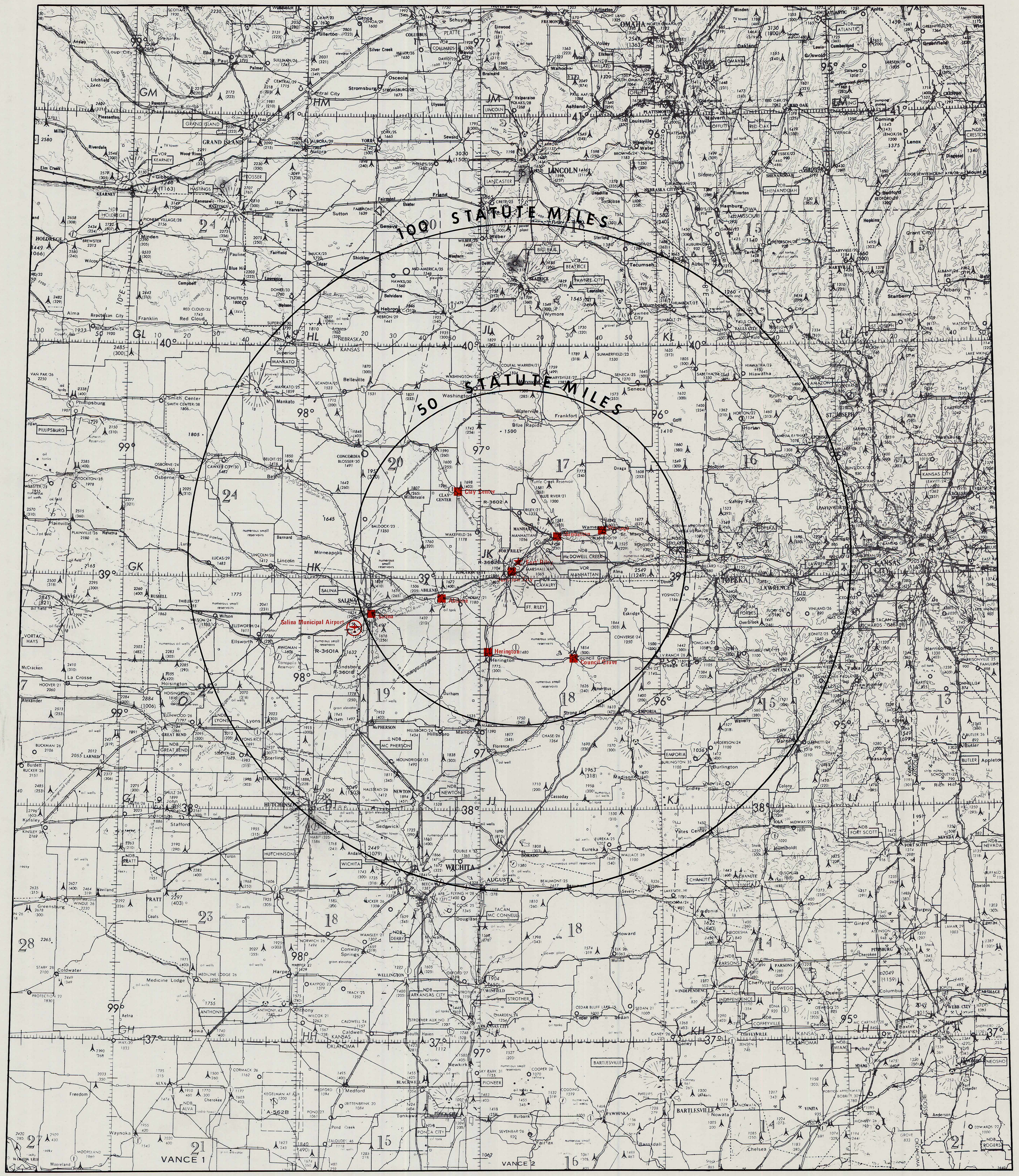
B. URBAN AREAS (Continued)

NAME AND LOCATION	POPULATION	HOUSING AVAILABILITY	EDUCATION FACILITIES	MEDICAL FACILITIES	RECREATION FACILITIES	PUBLIC UTILITIES	REMARKS
Salina, Kansas (Saline County) 38°50'N 97°37'W	1970 Census 37,714 Estimated 1977 39,682 Projected 1980 41,500	**Houses** Number of houses 13,251 Number of houses rented 1,045 Average monthly rent $200 and up Percent rental vacancies 7 9% New home starts, 1976 378 Average number of sales per year 1,184 Average sale price $27,484 **Apartments:** Number of apartments 2,024 Average monthly rent $150–$225 Average percent vacant 10 4% (1977 Data)	**Elementary Schools** Number of schools 17 Enrollment capacity No data Current enrollment 4,711 Projected enrollment, 1980 4,300 Expansion plans None **Junior High Schools** Number of schools 3 Enrollment capacity No data Current enrollment 1,557 Projected enrollment, 1980 1,590 Expansion plans None **High Schools** Number of schools 3 Enrollment capacity No data Current enrollment 3,111 Projected enrollment, 1980 3,027 Expansion plans None **Vocational Schools** Number of schools 2 Current enrollment 712 **Colleges and Universities** Number 3 (Kansas Wesleyan, Marymount College, Brown Mackie College) Current enrollment 1,800 (1976-1977 Data)	**Doctors** Total number 55 Doctor/population ratio 1/721 **Dentists** Total number 26 Dentist/population ratio 1/1,526 **Hospitals** Total number 2 Total beds 360 Coronary-care units 2 Intensive care units 2 Expansion plans None	**Parks** 6 **Athletic Fields.** 2 **Tennis Courts.** 17 **Golf Courses** 3	**Electric Power** Source Kansas Power and Light Co Distributor Kansas Power and Light Co Type Coal, gas, and oil-fired thermoelectric plants Expansion plans 1 coal-fired plant under construction (Jeffrey Energy Center) **Sewage Disposal** Number of treatment plants 2 Total capacity 8 4 MGD Average daily flow 5 4 MGD Type of treatment Secondary Expansion plans None **Heating Fuels.** Type available Natural gas, propane, butane, fuel oil Expansion plans None **Water Supply** Source Salina Water and Sewerage Department, 13 wells and Smoky Hill River Adequacy of service Adequate Expansion plans None	
Wamego, Kansas (Pottawatomie, County) 39°13'N 96°17'W	1970 Census 2,507 Estimated 1977 2,900 Projected 1980 3,000	**Houses** Number of houses 1,087 Number of houses rented 137 Average monthly rent $160 Percent rental vacancies None New home starts, 1976 61 Average number of sales per year 41 Average sale price $31,500 **Apartments** Number of apartments 60 Average monthly rent $150 Average percent vacant None (1977 data)	**Elementary Schools** Number of schools 1 Enrollment capacity 780 Current enrollment 780 Projected enrollment, 1980 No data Expansion plans Bond vote for new construction anticipated in 1977 **Junior High Schools.** Number of schools None **High Schools** Number of schools 1 Enrollment capacity 380 Current enrollment 380 Projected enrollment, 1980 No data Expansion plans None (1976-1977 Data)	**Doctors** Total number 3 Doctor/population ratio 1/967 **Dentists·** Total number 2 Dentist/population ratio 1/1,450 **Hospitals·** Total number 1 Total beds 26 Coronary-care units None Intensive care units None Expansion plans No data	**Parks** 1 **Athletic Fields·** None **Tennis Courts.** 1 **Golf Courses.** 1	**Electric Power:** Source Kansas Power and Light Co Distributor Kansas Power and Light Co Type Coal, gas, and oil-fired thermoelectric plants Expansion plans 1 coal-fired plant under construction (Jeffrey Energy Center) **Sewage Disposal·** Number of treatment plants 1 Total capacity No data Average daily flow No data Type of treatment No data Expansion plans No data **Heating Fuels.** Type available Natural gas, propane, butane Expansion plans No data **Water Supply** Source City Municipal, wells Adequacy of service Adequate Expansion plans No data	

[1] MGD refers to million gallons per day

FORT RILEY, KANSAS

TERRAIN ANALYSIS



Scale 1:1,000,000

20 0 20 40 60 Statute Miles

20 0 20 40 60 80 Kilometers

OFF-POST FEATURES

- Urban Area
- Airfield
- Cantonment Area

Prepared by Soil Systems, Incorporated, Marietta, Georgia, under the direction of the Terrain Analysis Center, U. S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia. December 1977.

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